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NATIONAL DAM SAFETY PROGRAM. HIGH CREST LAKE DAM (NJ 00225), PA--ETC(U)
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LEVEL II

PASSAIC RIVER BASIN
TRIBUTARY TO PEQUANNOCK RIVER
PASSAIC COUNTY
NEW JERSEY

HIGH CREST LAKE DAM
NJ 00225

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Approved for public release;
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DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

May, 1979

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Weir	High Crest Lake Dam, N.J.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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IN REPLY REFER TO
NAPEN-D

30 MAY 1979

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for High Crest Lake Dam in Passaic County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, High Crest Lake Dam, a high hazard potential structure, is judged to be in fair overall condition. However, the spillway is considered inadequate since 61 percent of the Probable Maximum Flood (PMF) would overtop the dam. To insure adequacy of the structure, the following actions, as a minimum are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980. In the interim, a detailed emergency operation plan and warning system, should be promptly developed. Also, during periods of unusually heavy precipitation, around the clock surveillance should be provided.

b. The following remedial actions should be completed within six months from the date of approval of this report:

(1) The seepage at the toe of the lined spillway channel should be assessed and any necessary corrective action taken. If necessary, piezometers should be installed in adjacent areas of the embankment and abutment to monitor the phreatic surface.

(2) The spalled and eroded concrete facing of the spillway weir should be repaired and the wing walls should be replaced or repaired as needed.

(3) The roadway material covering the downstream face of the dam which is now, in effect, the face of the dam should be graded to a slope of 2H:1V and either seeded with grass or covered with stone.

(4) Locate the valve box of the outlet works in order to determine the condition of the valve and pipe and repair as necessary. The valve should be periodically operated thereafter.

(5) The rocks which are piled on the left side of the spillway weir should be removed.

(6) An emergency warning system should be established and implemented in cooperation with local authorities to advise people downstream of flooding potential, either directly or by posting.

(7) The owner should have a survey made to determine the configuration of the dam and appurtenances after remedial measures have been implemented.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman James A. Courter of the Thirteenth District. Under the provisions of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

NAPEN-D
Honorable Brendan T. Byrne

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
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HIGH CREST LAKE DAM (NJ00225)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 3 and 20 December 1978 by Jenny-Leedshill Engineers under contract to the State of New Jersey. The State, under agreement with the U. S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

High Crest Lake Dam, a high hazard potential structure, is judged to be in fair overall condition. However, the spillway is considered inadequate since 61 percent of the Probable Maximum Flood (PMF) would overtop the dam. To insure adequacy of the structure, the following actions, as a minimum are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980. In the interim, a detailed emergency operation plan and warning system, should be promptly developed. Also, during periods of unusually heavy precipitation, around the clock surveillance should be provided.

b. The following remedial actions should be completed within six months from the date of approval of this report:

(1) The seepage at the toe of the lined spillway channel should be assessed and any necessary corrective action taken. If necessary, piezometers should be installed in adjacent areas of the embankment and abutment to monitor the phreatic surface.

(2) The spalled and eroded concrete facing of the spillway weir should be repaired and the wing walls should be replaced or repaired as needed.

(3) The roadway material covering the downstream face of the dam which is now, in effect, the face of the dam should be graded to a slope of 2H:1V and either seeded with grass or covered with stone.

(4) Locate the valve box of the outlet works in order to determine the condition of the valve and pipe and repair as necessary. The valve should be periodically operated thereafter.

(5) The rocks which are piled on the left side of the spillway weir should be removed.

(6) An emergency warning system should be established and implemented in cooperation with local authorities to advise people downstream of flooding potential, either directly or by posting.

(7) The owner should have a survey made to determine the configuration of the dam and appurtenances after remedial measures have been implemented.

APPROVED: James G. Ton

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 30 May 1979

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	High Crest Lake Fed. I.D. No. NJ 00225
State Located:	New Jersey
County Located:	Passaic
Stream:	Unnamed stream tributary to Pequannock River
Dates of Inspection:	December 3 and 20, 1978

Brief Assessment of General Condition of Dam

The visual inspection of the dam indicated the dam to generally be in fair overall condition but in need of remedial measures. The spillway is inadequate since it can pass only 60 percent of the probable maximum flood, and a downstream bridge opening slightly restricts the flow. The spillway is structurally in poor condition due to failure cracks and spalling of the concrete.

It is recommended that the outlet works controls be located and their operating condition assessed very soon. The spillway should be repaired and wing walls repaired or replaced as soon as possible. An assessment of the seepage problem at the toe of the spillway channel should also be made as soon as possible and corrective action taken. Other recommendations are of a less urgent nature and should be implemented in the near future. These include grading of the downstream slope of the embankment, removal of rocks behind the

spillway weir and implementation of a downstream warning system. More detailed and sophisticated hydraulic and hydrologic studies are recommended to more accurately determine the spillway capacity prior to any remedial action.

Frank L. Panuzio

Frank L. Panuzio, P.E.
Project Manager

Robert J. Jenny, P.E.
Project Director
New Jersey License No. 9878

Vie

HIGH CREST LAKE DAM

2

View of upstream side of dam and spillway.

(December 3, 1978)

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

HIGH CREST LAKE DAM
Federal I.D. No. NJ 00225
New Jersey I.D. No. 448

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The National Dam Inspection Act, Public Law 92-367, 1972 provides for the National Inventory and Inspection Program by the U. S. Army Corps of Engineers. This report has been prepared in accordance with this authority, through contract between the State of New Jersey and Jenny-Leedshill Engineers. The State of New Jersey has also entered into an agreement with the U. S. Army Engineer District, Philadelphia, to have this work performed.

b. Purpose of Inspection

The purpose of this inspection was to evaluate the general structural integrity and hydraulic adequacy of the dam, and to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

a. Description of Dam and Appurtenances

High Crest Lake Dam is an earthfill structure which impounds a reservoir of 395 acre feet maximum capacity on an unnamed stream tributary to Pequannock River. The dam is 21.5 feet high, 520 feet long and has a concrete core wall extending the length of the embankment. A clay puddle core is on either side of the concrete core wall.

The upstream embankment is impervious earthfill with a slope of 2H:1V, while the downstream is pervious earthfill with a slope of 1-1/2H:1V. The spillway is a concrete ogee structure, 45 feet long, constructed at the right (east) abutment. A few feet downstream of the spillway the channel is restricted at a bridge opening. The roadway across this bridge continues along almost the entire length of the embankment crest, and fill from the roadway has obscured the original downstream slope of the embankment. The emergency drain consists of a 12-inch cast iron pipe with a gate valve near the downstream toe of the dam.

b. Location

The dam is located in northern New Jersey, about 12 miles northwest of Paterson, between the communities of Apshawa and Smith Mills in West Milford Township, Passaic County. The location of the dam is shown on Plate 1.

c. Size Classification

Based on the 21.5 foot structural height of the dam and the 395 acre feet maximum storage capacity of the reservoir, the size classification is small. The criteria for size classification of dams are set forth in the Corps' Guidelines. A small size dam is one in which the maximum storage capacity of the reservoir is equal to or greater than 50 acre feet and less than 1000 acre feet, and/or the height of the dam is equal to or greater than 25 feet and less than 40 feet.

d. Hazard Classification

The dam is classified as high hazard because of the potential loss of more than a few lives and excessive property damage that could result in event of failure. Three houses just downstream are indicated on the topographic map (Plate 1), and there are major highway and other developments further downstream in the Borough of

Butler (population 7,000), about one mile downstream.

e. Ownership

The dam is owned and maintained by High Crest Lake Lodge, Inc., c/o Fred Wilson, 192 High Crest Drive, West Milford, New Jersey 07480. West Milford Township owns the road right-of-way along the crest of the dam and for this reason may own part of the dam.

f. Purpose of Dam

The dam impounds a reservoir used for recreation and aesthetic purposes.

g. Design and Construction History

The dam was constructed in 1951-1952 by Highland Lakes, Inc., for purposes of developing real estate surrounding the reservoir. Previously there had been a small dam in what is now the upper part of the reservoir. The new dam, which was at first called Apshawa Lake Dam, was designed by Newell C. Harrison, P.E. In about 1972 ownership of the dam passed from Seckler and Shepperd, Inc., a real estate firm, to High Crest Lake Lodge, Inc., an association of local homeowners. The roadway along the crest of the dam was built by West Milford Township.

h. Normal Operational Procedures

The reservoir is normally unregulated. It was reported that the reservoir level is frequently below the spillway crest elevation. There are no monitoring devices on the dam.

1.3 Pertinent Data

a. Drainage Area - 0.6 square miles

b. Discharge at Damsite (cfs)

- Maximum known flood at damsite - Not known.
- Spillway capacity (elevation 635.5) - 1125

c. Elevation (ft. above MSL)*

·Top Dam	635.5
·Spillway crest	632
·Streambed at centerline of dam	614

d. Reservoir Length (ft.)

·Top of dam	3,100
·Spillway crest	3,000

e. Storage (acre-feet)

·Recreation pool (spillway crest)	240
·Top of dam	395

f. Reservoir Surface (acres)

·Top dam	46
·Spillway crest	40

g. Dam

·Type	Earthfill
·Length	520 ft.
·Height	21.5 ft.
·Top Width	10 ft.
·Side Slopes	
- Upstream	2H:1V
- Downstream	1.5H:1V
·Core	Concrete core wall
·Zoning	Impervious upstream, pervious downstream, clay puddle around core wall

*Elevations based on U.S.G.S. topographic maps, since elevations on plans (Plates 2 and 3) are believed to be based on an assumed datum.

h. Spillway

·Type	Ogee
·Length of weir	45 ft.
·Crest elevation	632 ft.
·Base elevation	627 ft.
·U/S Channel	45° Training walls
·D/S Channel	Paved channel leading to bridge opening

i. Regulating Outlet

·1-12 in. diamter C.I. emergency outlet pipe and gate valve

SECTION 2: ENGINEERING DATA

2.1 Design

a. Geological Conditions

High Crest Lake Dam is located in what appears to be a glacially scoured basin in the New Jersey Highlands physiographic province. Appendix C to this report contains a discussion of the regional geology of this province.

The reservoir occupies a relatively broad valley which is situated at approximately right angles to the valley of the Pequannock River. The unusually high elevation change in a short horizontal distance (160 feet in 1500 feet) between the lake and the river may be a reflection of the lake valley's geologic history as a "hanging valley" during the recent glacial epochs.

Based on the visual inspection, the dam embankment and spillway only occupy a small portion of the east side of the valley. However, the shape of the upstream reservoir and the right abutment are such that it would appear that a natural barrier was deposited across the valley, perhaps as a recessional or lateral moraine. The remnant of this moraine is the wide, flat ridge which serves as the right abutment of the dam. Although confirming data is lacking, from topographic evidence it would appear that a smaller lake occupied the valley and the level of the lake was raised with the present embankment and spillway.

On the left abutment where it has not been disturbed by the construction of houses, the overburden appears to be boulder till with numerous boulders more than 18 inches in diameter. In the valley bottom below the

dam, the soil is primarily sand, gravel and boulders which make up the recent alluvium. No bedrock is exposed near either abutment of the dam. It must be assumed, however, that Pre-cambrian gneiss and granite underly the site at a depth which could not be determined by visual inspection. Inspection reports at the time of construction indicate that the foundation of the core wall was a yellow clay. Bedrock is exposed upstream of the dam in the reservoir.

The dam is located in Seismic Zone 1, indicating that only minor damage from distant earthquakes should be expected.

b. Design Data

Data regarding the design of the dam are largely limited to the design drawings (Plates 2 and 3). The embankment was designed with a concrete core wall extending into the foundation material below the embankment. The core wall is indicated to be 2 feet thick at the base and about 1 foot thick at the top. The State required that the base of the core wall be 3 feet thick in the area of the former streambed. Within the embankment the design called for a clay puddle to be placed on either side of the core wall, with impervious fill upstream of the clay puddle and pervious fill downstream of it.

The spillway weir was designed with compounded circular curves of 1 foot radius at the crest and 3 feet at the base. Correspondence indicates that the spillway was designed for a capacity of 500 cfs at 2.16 feet head on the spillway. The design capacity was furnished by the State.

The State specified that concrete collars be placed along the blow-off pipe to prevent seepage along the pipe.

2.2 Construction

The dam was constructed in accordance with the design drawing, but with two major exceptions. The core wall footing was constructed much deeper than called for in the design (Plate 2) and about 10 feet thick between Stations 80 and 2+60 due to a cave-in of the trench. The other exception to the design drawings is in the configuration of the downstream training walls of the spillway, which are now angled into the bridge opening downstream (Plate 4). This may have been a post-construction change.

The construction was inspected by the State and the dam was accepted on November 3, 1952.

2.3 Operation

The reservoir is normally unregulated. The owner's representative stated that flow over the spillway seldom covers the entire length of the weir. The reservoir drain gate valve has not been operated in many years and was, in fact, concealed at the time of inspection by materials from the road embankment. No records of maintenance work or post-construction inspections are available.

2.4 Evaluation

a. Availability

Limited data on design are available from the design drawings. Some data on construction are available from State inspection reports.

b. Adequacy

Available data are insufficient to quantitatively evaluate the design. Calculations relating to the structural design of the dam or the stability of the as-built structure are not available. Specifications are not available, knowledge of construction methods is limited, and nothing is known of as-built material properties. Foundation conditions are not well known.

c. Validity

Design drawings do not reflect the as-built configurations of the core wall or the downstream spillway training walls. In other respects they are believed to represent as-built conditions, except for the roadway materials which now cover the crest and downstream embankment.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The visual inspections of High Crest Lake Dam were made on December 3 and 20, 1978. The water surface elevation at the time of the first inspection was approximately 636 feet, or about a foot below the base of the spillway. The reservoir had been lowered in October by siphoning, because of the owner's concern about the lack of accessibility of the emergency outlet control valve.

The visual inspection did not reveal any critical signs of distress in the dam. No seepage was observed because of the low reservoir level, but seepage is reported to occur below the spillway. The spillway is in need of repair, and both wingwalls of the spillway have failure cracks. The emergency outlet has seldom been operated and the valve chamber housing the controls is buried by debris from a roadway embankment.

Detailed inspection was made of the dam, appurtenant structures, reservoir area, and the downstream channel. Descriptions of the findings of these inspections are summarized in the paragraphs which follow. The checklist of visual inspection items is included in Appendix A. Geologic and foundation conditions observed at the time of inspection are noted in greater detail in Section 2.1-a.

b. Dam

The dam was inspected for signs of settlement, seepage,

erosion, cracking and any other evidence of undesirable behavior which might affect the stability of the structure. The crest of the dam is obscured by a roadway (Photo 1), and the downstream embankment is entirely covered by material from the roadway embankment (Photo 2). The road was being surfaced with asphalt at the time of inspection, thus any cracking or misalignments in the crest could not be observed. The top of the concrete core wall was exposed for about 40 feet to the left of the spillway, in an area not covered by the road paving (Photo 3). This would indicate that there has been some minor erosion or settlement of the embankment.

No seepage was observed because of the low reservoir level, nor was there any evidence that it had occurred in the past. However, the owner's representative reported that when the reservoir is full there is a small amount of seepage in the stream channel just below the paved spillway apron. The source of seepage is apparently beneath the spillway or an adjacent area of the embankment or right abutment.

c. Appurtenant Structures

Spillway

The spillway is in need of repair. There is local spalling and cavitation to a depth of 1-1/2 inches along the crest of the weir (Photo 4), and there are small cracks filled with leaching deposits on the downstream side of the weir (Photo 5). The downstream toe of the weir is eroded and rough (Photo 5). The weir has been patched at a number of places, including the spalled downstream surfaces adjoining a construction joint. There is a large pile of rocks on the upstream left side of the spillway (Photo 6).

Both wing walls of the spillway have failure cracks. The left wing wall has a 3/4-inch wide vertical crack above the crest of the weir (Photo 6), while the right wing wall has a sloping crack about 20 feet long extending from the upstream training wall to well downstream of the weir (Photo 7). There is horizontal displacement along the cracks in both wing walls, leaving no doubt that the wing walls have failed and are no longer safely performing their function.

Outlet

The emergency outlet control valve and outlet pipe were covered with some 18 feet of road embankment material when the roadway along the crest of the dam was constructed. At the time of the inspection the owner had been excavating some of this material in an attempt to locate the valve box, but had been unable to find it as yet. The inlet to the reservoir drain was submerged, thus no part of the outlet works could be inspected.

d. Reservoir Area

The area surrounding the reservoir has moderate to steep slopes and is heavily wooded. Numerous residences surround the lake. There was no evidence of excessive sedimentation in the reservoir.

The principal inlet is at the northern end of the reservoir. It consists of two 24-inch concrete pipes which convey water from a spring-fed stream and from another stream which drains two small nearby ponds.

e. Downstream Channel

There is an 11.4 feet wide bridge opening just downstream of the spillway (Photo 8). Concrete training

walls on either side of the lined stilling basin direct the flow from the 45-foot width at the base of the spillway to the much narrower bridge opening. The channel is paved and lined by masonry training walls for about 6 feet below the bridge opening. The training walls and paving are in good condition both upstream and downstream of the bridge.

The streambed follows the right (west) side of a broad meadow (Photo 9). Below the meadow it becomes a well-defined, steep-sided channel through heavily wooded slopes.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

The reservoir is operated to maintain maximum water levels for recreational and aesthetic purposes. There has been little or no regulation of the reservoir other than the recent lowering which was done by siphoning, because of the inaccessibility of the outlet controls. Normally, flow over the spillway is reported to occur only in the spring.

4.2 Maintenance of Dam

There has been no maintenance of the embankment, so far as is known. The spillway shows signs of minor patching of the concrete, but it has deteriorated considerably since then.

4.3 Maintenance of Operating Facilities

The reservoir drain controls and outlet have been concealed by overburden from the road embankment that was constructed after the dam was built. Thus there has been no maintenance of the outlet works for a number of years.

4.4 Description of Warning System

There is no warning system or emergency contingency plan in event of possible dam failure or overtopping.

4.5 Evaluation of Operational Adequacy

In general, maintenance of the dam and spillway has been deficient. The spillway is especially in need of repair. The condition of the outlet controls must be determined, once they are located by the owner. No records of operation or maintenance have been kept.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

As stated in Section 1.2, High Crest Lake Dam is classified as high hazard and small in size. In accordance with the Corps of Engineers', "Recommended Guidelines for Safety Inspection of Dams," the Spillway Deisign Flood (SDF) should be 50% to 100% of the Probable Maximum Flood (PMF). The 100% PMF was selected as the SDF because of the high hazard to loss of life immediately downstream of the dam.

Data obtained from State files indicate the drainage basin area of the dam is 0.6 square miles. Elevations within the basin range from a maximum of about 900 feet above mean sea level along the perimeter to a minimum of about 614 feet in the valley floor. Land use patterns within the watershed consist of forests and residential areas. About 10 percent of the watershed area is the reservoir. The drainage basin is delineated on a U.S.G.S. topographic map and is presented on Plate D-1, Appendix D.

The hydraulic and hydrologic features of the dam were evaluated using criteria set forth in the Corps of Engineers' "Recommended Guidelines for Safety Inspection of Dams", and additional guidance and criteria provided by the Philadelphia District, Corps of Engineers.

The Probable Maximum Precipitation (PMP) was calculated

using Hydrometeorological Report No. 33 and the Hop Brook reduction factor of 0.80 for misalignment of the storm.

The Probable Maximum Flood (PMF) was calculated using the Corps' computer program HEC-1, Dam Break Version. In computing the PMF the Corps requested that the SCS triangular unit hydrograph with curvilinear transformation be used. The computer program was used to calculate this unit hydrograph from the basin log. A lag time of 0.3 hours was calculated for the basin and used in the program.

An initial infiltration loss of 1.0 inch and a final infiltration loss rate of 0.10 inch per hour were used in the HEC-1 program to give the rainfall excess. Using the excess rainfall and the unit hydrograph, the program computed peak inflow of the 25 percent, 50 percent, 75 percent and 100 percent PMF. These discharges are approximately 1070 cfs, 2130 cfs, 3200 cfs, 4270 cfs, respectively.

The various percentages of the PMF inflow hydrograph were routed through the reservoir using the Modified Puls Method by the HEC-1 DB program. The peak outflow of the 25 percent, 50 percent, 75 percent, and 100 percent PMF were calculated to be approximately 370 cfs, 920 cfs, 1540 cfs and 2460 cfs, respectively. The flood routings indicate that all floods greater than about 60 percent of the PMF will overtop the dam. A plot of percent PMF versus peak outflow discharge is presented on Plate D-2, Appendix D.

The spillway and overtop stage-discharge rating curve used in the flood routings was calculated using the weir equation. The spillway has an ogee crest. The

stage-discharge curve of the spillway was estimated using the Bureau of Reclamation procedures that are presented in their text, "Design of Small Dams". Tailwater effects caused by a roadway passing over the spillway chute were included in the estimate. The overtop stage-discharge rating curve was calculated using a discharge coefficient of 3.1 and assuming free overflow across the whole length of the dam. The spillway and overtop stage-discharge rating curve for High Crest Lake Dam is presented in Appendix D as Plate D-3.

The reservoir stage-storage curve used in the flood routings was determined from U.S. Geological Survey 7.5-minute topographic maps and data obtained from State files. The stage-storage curve was extended above the dam crest to include surcharge storage during flood peak discharges. The stage-storage curve is presented in Appendix D as Plate D-4.

In the reservoir routing computations, possible discharges through the outlet works were excluded because their capacity is small compared to the PMF and because of the possibility that the outlet valves may be closed.

The various percentages of the PMF were routed 0.25 miles downstream through two successive reaches through the small community of Smiths Mills to a station just upstream of State Route 23. These routings were made to determine downstream flooding characteristics. The locations of cross-sections used in the routings are given in Appendix D, page D-12. The flood depth, width and mean flow velocity of the four flood flows at the community of Smiths Mills are summarized in the following tabulation:

Flooding Characteristics at Smith Mills

	25% PMF	50% PMF	75% PMF	PMF
Peak Discharge, cfs	370	920	1540	2450
Peak Flood Depth, ft.	1.4	2.6	3.5	4.5
Peak Flood Top Width, ft.	20	30	50	70
Peak Flow Velocity, fps	13.2	16.5	16.4	15.7

The drain outlet for High Crest Lake has its intake at the reservoir floor and is 12 inches in diameter. Using the orifice equation and assuming no inflows into the lake or tailwater at the outlet, the time required to drain the lake when at spillway level (normal pool) was calculated to be about 9 days.

b. Experience Data

Records of lake levels are not maintained for this site. The reservoir is operated to maintain maximum water levels for aesthetic and recreational purposes. There is no indication that the dam has ever been overtopped.

c. Visual Observations

Downstream of the spillway crest, the spillway chute angles toward the main stream. passes under the roadway which runs along the dam crest, and, at the same time, decreases in width. Downstream of the roadway box culvert the spillway chute discharges into the stream which was dry at the time of the inspection.

For a short distance downstream of the dam the flood plain is a relatively flat grass covered meadow.

Farther downstream the stream slope becomes very steep. The main channel and overbank have a cross-

section that is triangular in shape. The main channel is filled with large rocks and the banks and overbanks are thickly wooded with little undergrowth.

d. Overtopping Potential

As indicated in Section 5.1-a, all floods greater than about 60 percent of the PMF, when routed through the reservoir, will overtop High Crest Lake Dam. The PMF will overtop the dam by 1.3 feet for 2.1 hours. This overtopping height assumes tha dam will remain in its current condition. In accordance with the Corps' Guidelines, the spillway should be classified as Inadequate.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There are no visible indications of any distress in the embankment; however, only the upstream face can now be observed because of the roadway material presently covering the crest and downstream face. The riprap is in good condition.

The spillway is in poor condition. There is considerable spalling and erosion of the concrete weir, and the wing walls have significant diagonal failure cracks with measurable displacement.

There reportedly is a small amount of seepage from under the toe of the lined spillway channel.

b. Design and Construction Data

Design drawings are available but there are no data on construction other than brief State inspection reports. Specifications are not available and there are no construction reports or as-built drawings. The design, as represented on the design drawings, appears to be satisfactory. Inspection reports indicate that a portion of the concrete core wall was constructed considerably deeper and wider than called for in the design.

c. Operating Records

There are no operating records of the reservoir, since it is not regulated. There are no records of repairs or post-construction inspections, and there is no instrumentation of the dam.

d. Post-Construction Changes

Construction of the roadway along the crest and

downstream embankment is not known to have affected the structural stability of the dam; however, it does make inspection difficult, and the downstream bridge opening reduces the maximum discharge capacity of the spillway by about 10 percent. The roadway probably offers some protection of the embankment, should the dam be overtopped.

e. Seismic Stability

The dam is located in Seismic Zone 1, in which it may generally be assumed that there is no hazard from earthquake, provided static stability conditions are satisfactory and conventional safety margins exist. A stability analysis would be required to determine whether the dam has satisfactory static stability.

SECTION 7: ASSESSMENT, RECOMMENDATIONS AND PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety

The spillway is inadequate since it can pass only 60 percent of the probable maximum flood. Structurally, the spillway is in poor condition and badly in need of repair.

The design of the dam appears to have been adequate, but the condition of the embankment cannot be well assessed since the crest and downstream slope are covered by road material. The road material has concealed the reservoir drain controls and outlet pipe, making this facility inoperable.

Seepage is reported from under the toe of the lined spillway channel.

b. Adequacy of Information

Data are insufficient to quantitatively evaluate the stability of the dam, since there are no data on the as-built configuration or material properties of the dam and foundation. There has been no recent survey of the dam to reflect post-construction changes. The condition of the outlet works is unknown.

c. Urgency

The outlet works controls should be located and their operating condition assessed very soon. Repairs to the

spillway and an assessment of the seepage problem should be made as soon as possible. Other recommendations are of a less urgent nature and should be implemented in the near future.

d. Necessity for Additional Data/Evaluation

Corps of Engineer Guidelines require that, in general, seepage and stability analysis should be on record for dams in the high hazard category. Based on the visual inspection and the fact that the dam appears to have been designed to satisfactory standards subject to State approval and construction inspection, it is considered that a stability analysis, although desirable, is not absolutely necessary at this time. Seepage is apparently a problem but this can be assessed as recommended in Section 7.2-b.

It is recommended that the owner have a survey made to determine the configuration of the dam and appurtenances after remedial measures have been implemented.

7.2 Remedial Measures

a. Corrective Procedures

It is recommended that the following corrective procedures be performed:

1. The seepage at the toe of the lined spillway channel should be assessed by a qualified professional engineer, and any necessary corrective action taken. If necessary, piezometers should be installed in adjacent areas of the embankment and abutment to monitor the phreatic surface.
2. The spalled and eroded concrete facing of the spillway weir should be repaired and the wing walls should be replaced or repaired as needed.

3. The roadway material covering the downstream face of the dam which is now, in effect, the face of the dam should be graded to a slope of 2H:1V and either seeded with grass or covered with stone.

4. The owner should undertake more detailed and sophisticated hydraulic and hydrologic studies to more accurately determine the spillway capacity. Depending on the results of these studies, remedial action should be taken as required.

b. Operation and Maintenance Procedures

It is recommended that the following operation and maintenance work be performed:

1. When the owner has located the valve box of the outlet works, the condition of the valve and pipe should be determined and repaired as necessary. The valve should be periodically operated thereafter.

2. The rocks which are piled on the left side of the spillway weir should be removed.

3. An emergency warning system in cooperation with local authorities should be established and implemented to advise people downstream of flooding potential, either directly or by posting.

PLATE 1

VICINITY MAP

JENNY - LEEDSHILL JANUARY 1979

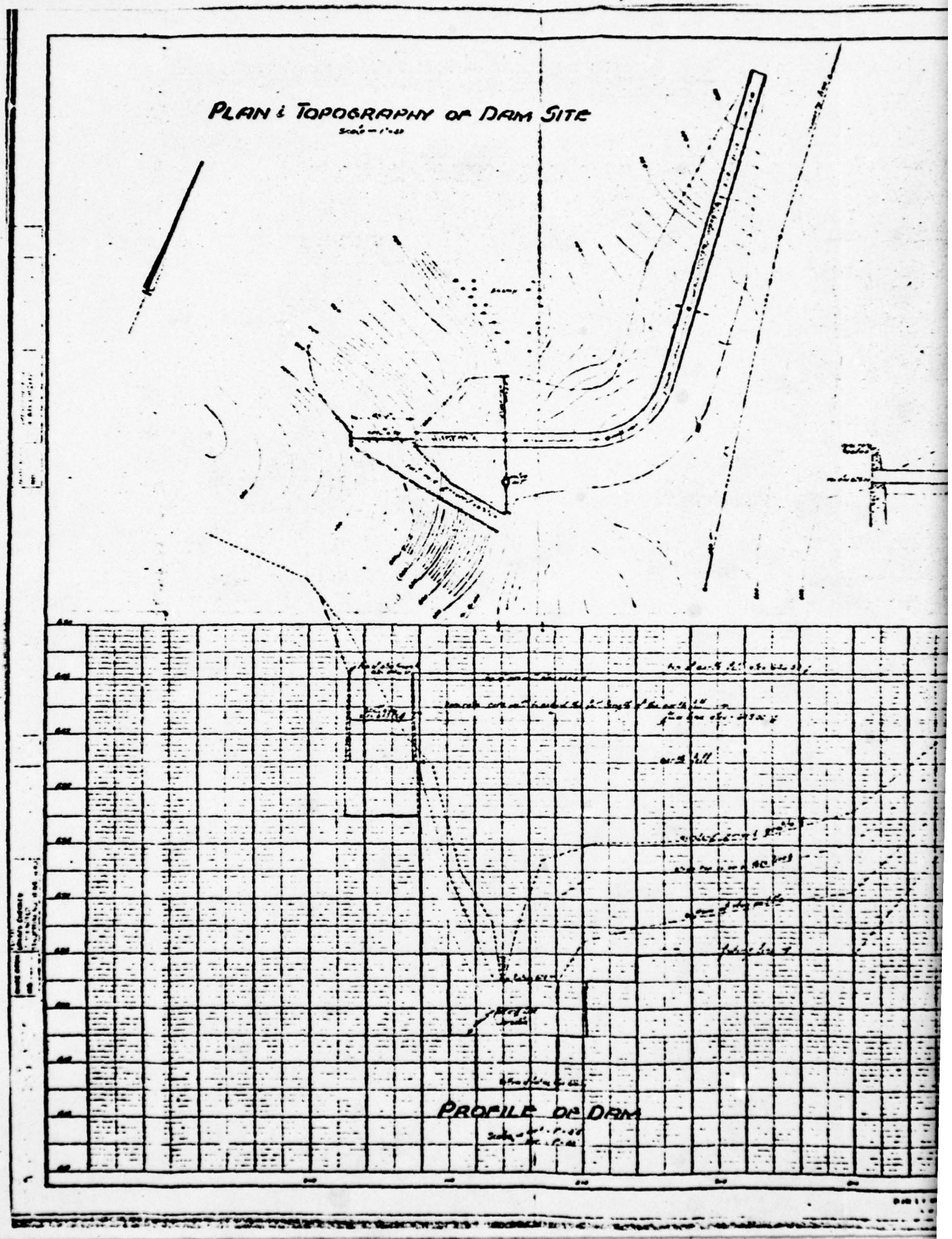
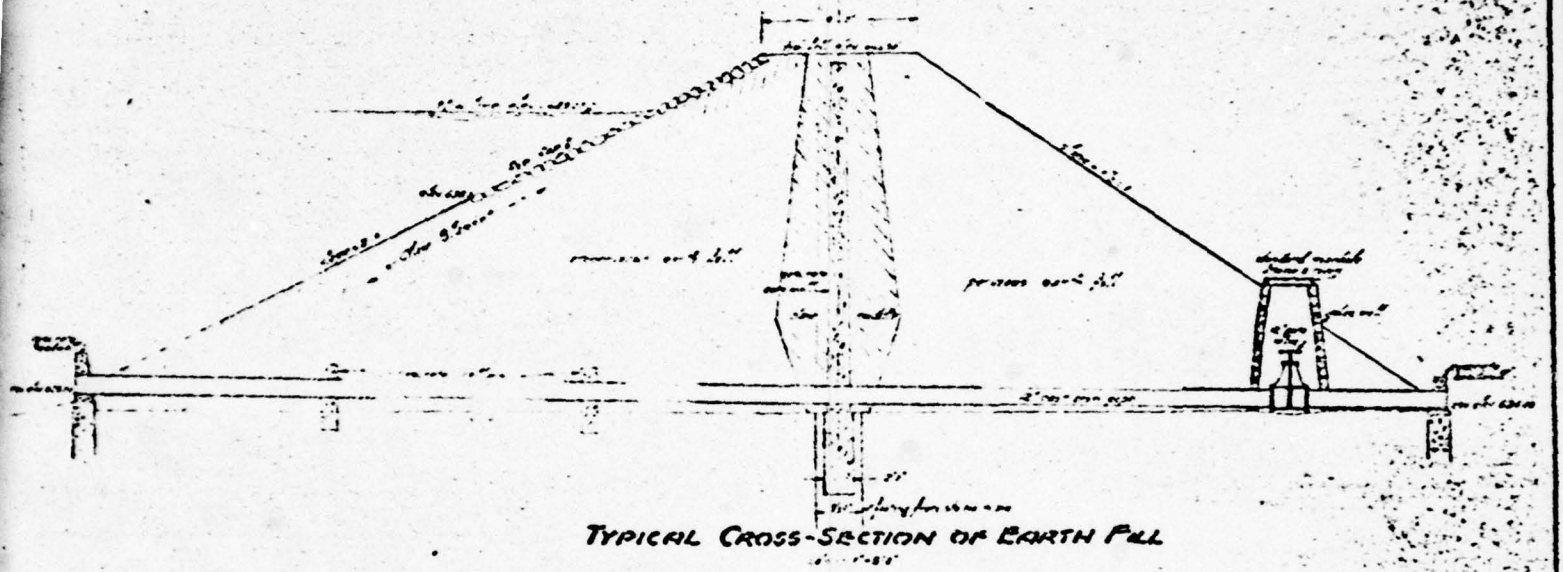

PLAN & TOPOGRAPHY OF DAM SITE
PROFILE OF DAM

PLATE 2



TYPICAL CROSS-SECTION OF EARTH FILL

FILE

FILE DAM APPLICATION No 448

DEPARTMENT OF CONSERVATION
AND ECONOMIC DEVELOPMENT

APPROVED JAN 11 1951

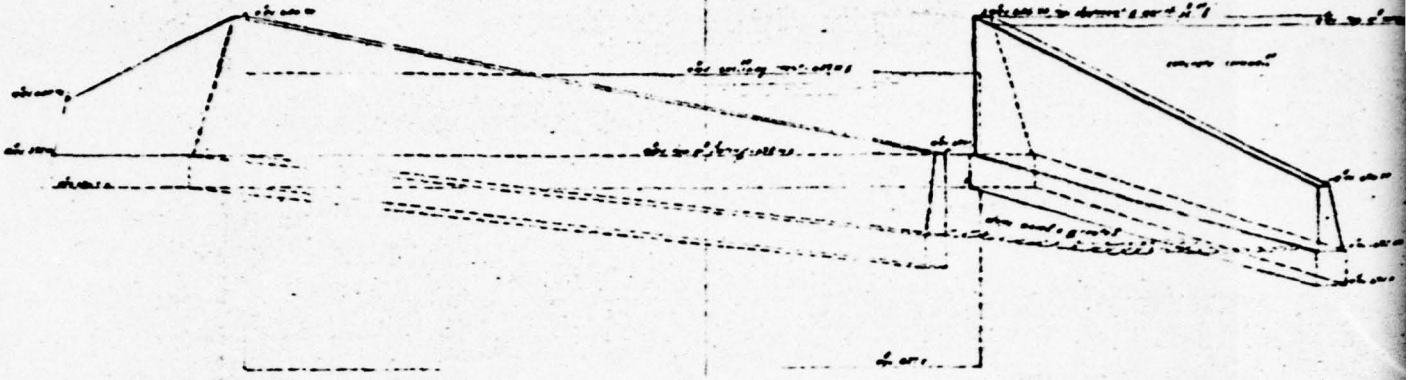
H. T. Critchlow

Director and Chief Engineer

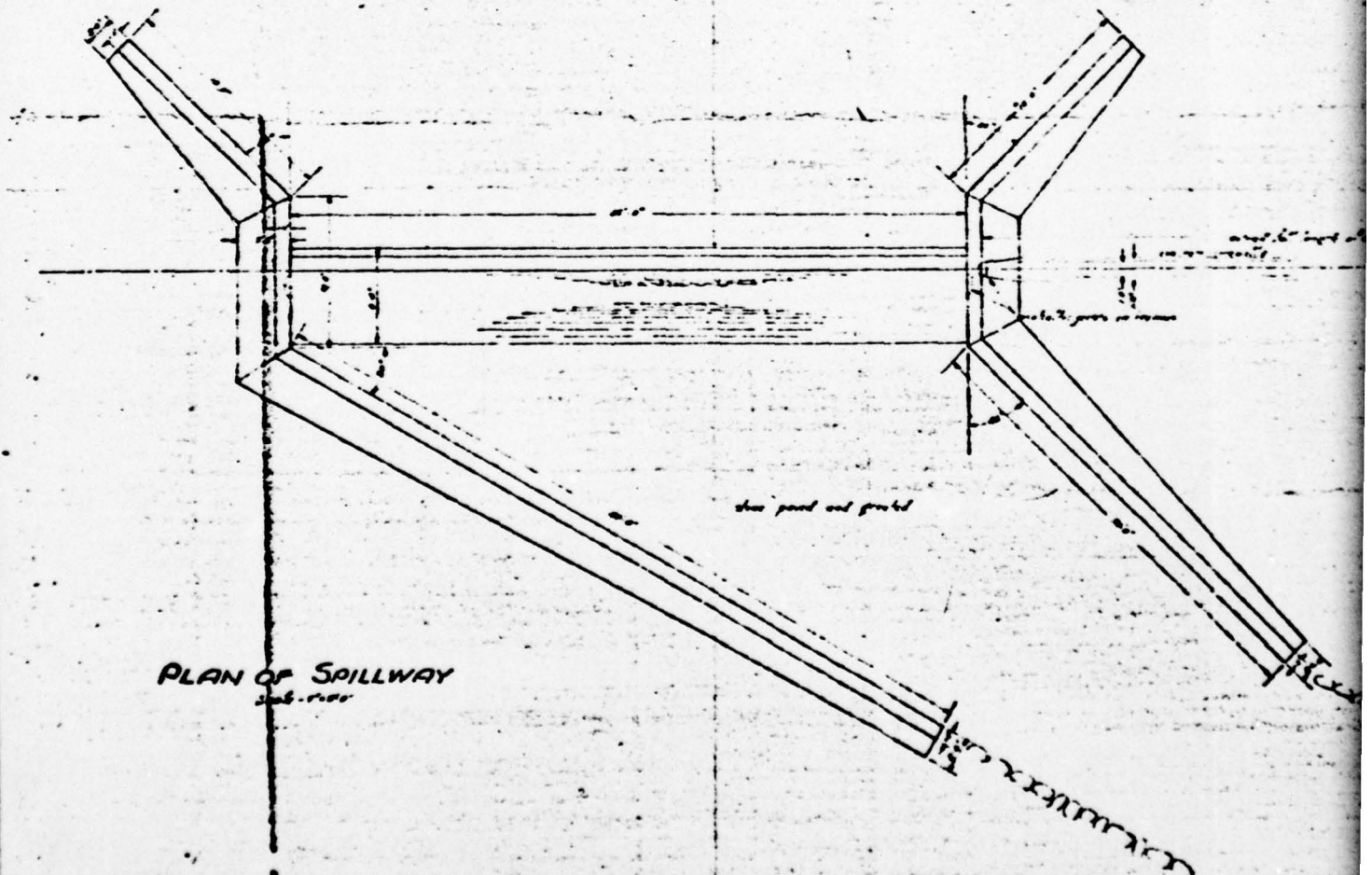
APSHAWA LAKE DAM

PROPERTY OF MONADNOCK LAKES [illegible]

DAM APPLICATION No 448

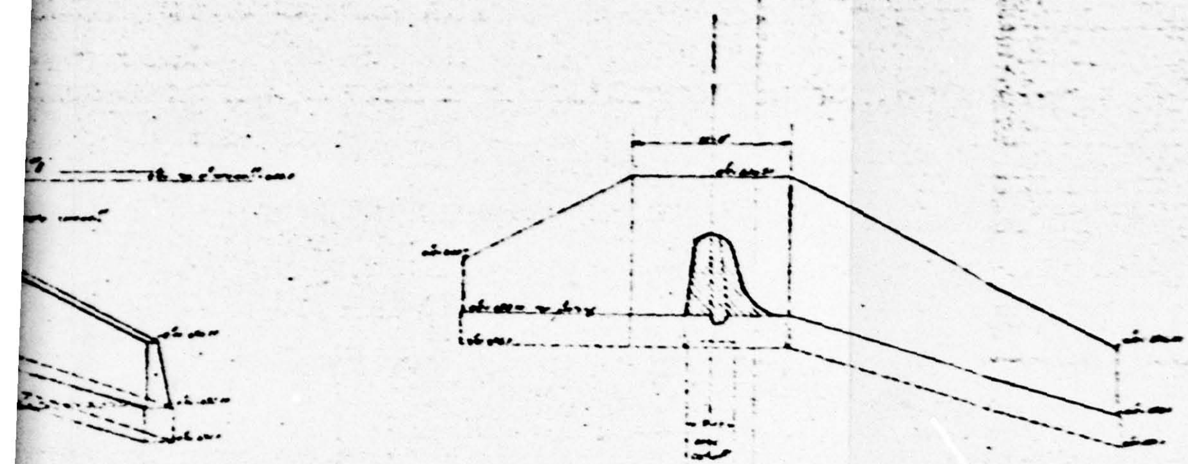


ELEVATION OF SPILLWAY

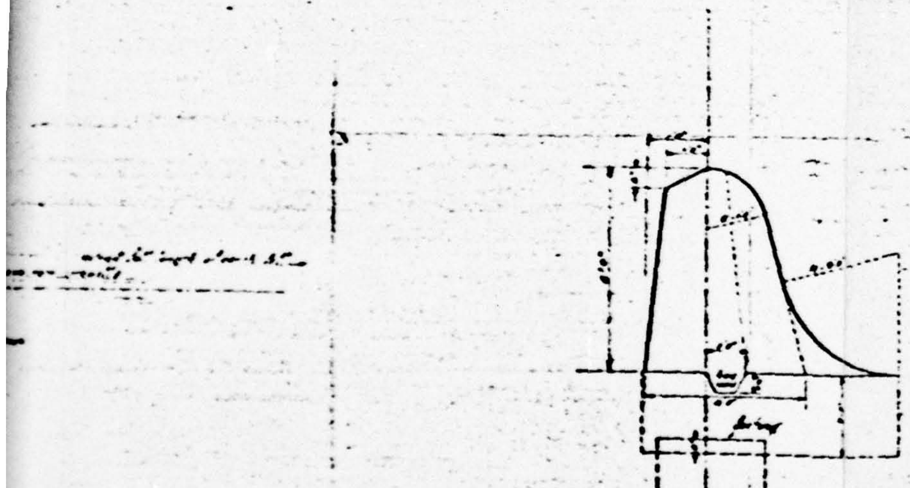


PLAN OF SPILLWAY

PLATE 3



ELEVATION OF EAST ABUTMENT



SPILLWAY SECTION

FILE

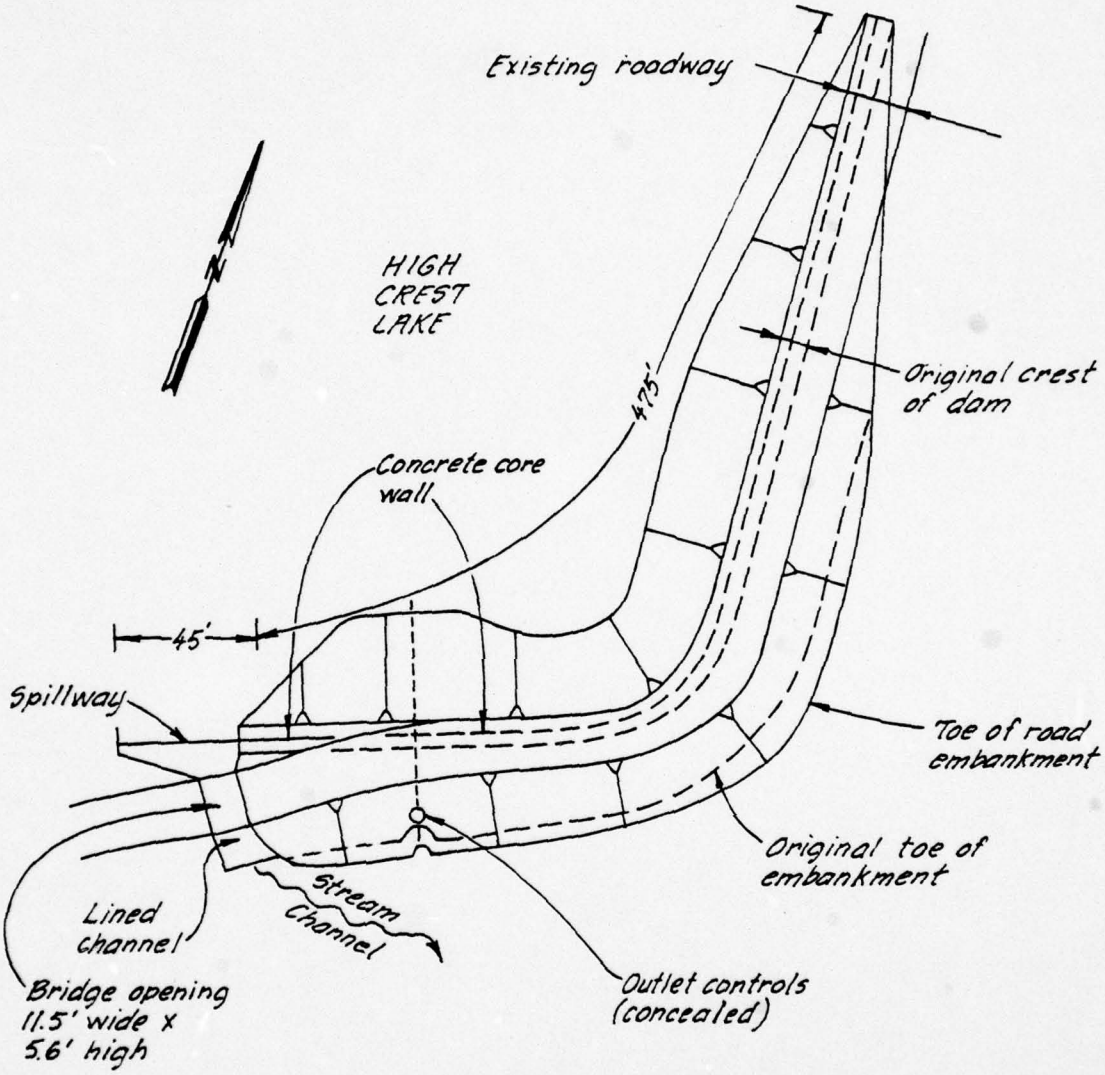
DAM APPLICATION No. 443
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
APPROVED JAN 11 1951
H. T. Critchlow

APSHAWA LAKE DAM

Property of Highland Lakes Incorporated
situated in the
Township of West Milford   Passaic County, N.J.

Manuel A. Harrison
Prof. Engineer
Butler N.J.

DAM APPLICATION No. 443



HIGH CREST LAKE DAM
GENERAL VIEW

JENNY- LEEDSHILL JANUARY 1979

APPENDIX A

CHECK LIST - VISUAL OBSERVATIONS

CHECK LIST - ENGINEERING, CONSTRUCTION MAINTENANCE DATA

Check List
Visual Inspection
Phase 1

Name Dam High Crest Lake County Passaic State New Jersey Coordinator NJ DEP

Corrdinates: Lat. 41° 00' 57" N
Long. 74° 22' 18" W

Date(s) Inspection Dec. 3, 1978
Dec.20, 1978 Weather Overcast Temperature 27°F

Pool Elevation at Time of Inspection ±636' M.S.L. Tailwater at Time of Inspection N/A M.S.L.

Inspection Personnel:

(December 3, 1978)
R. C. Gaffin
A. R. Slaughter
P. L. Wagner

(December 20, 1978)
R. J. Jenny
D. J. Lachel

F. L. Panuzio
A. L. Slaughter

P. L. Wagner Recorder

Owner Representative:

(December 3, 1978)

Fred Wilson, President
High Crest Lake Lodge, Inc.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEEPAGE OR LEAKAGE	Not Applicable	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	Not Applicable	
DRAINS	Not Applicable .	
WATER PASSAGES .	Not Applicable	
FOUNDATION	Not Applicable	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBERSVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Not Applicable	
STRUCTURAL CRACKING	Not Applicable	
VERTICAL AND HORIZONTAL ALIGNMENT	Not Applicable	
MONOLITH JOINTS	Not Applicable	
CONSTRUCTION JOINTS	Not Applicable	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	Road embankment now covers most of the original dam crest and downstream embankment. Road was being surfaced with asphalt, thus any cracks were obscured.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Road embankment now covers toe of dam. Much coarse material and boulders 2 to 5 ft. diameter.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Minor erosion or settlement around intersection of left spillway wing wall and core wall. No erosion of upstream of embankment. Downstream hidden by road embankment.	
VERTICAL AND HORIZONTAL ALINEMENT OF THE CREST	Obscured by roadway.	
RIPRAP FAILURES	None	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Scrub vegetation on downstream embankment of road - small trees and brush.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	About one foot of erosion or settlement of embankment on both sides of the spillway. Abutments are earth, with no evidence of separation or movement at juncture with the dam.	
ANY NOTICEABLE SEEPAGE	None observed (reservoir very low). It is reported that there is minor flow into stream just downstream of apron under bridge when the reservoir is nearly full but not spilling.	
STAFF GAGE AND RECORDER	None	
DRAINS	None	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Concrete spalled from center of ogee crest 18" x 6" area 1-1/2" deep. Vertical joint in center of spillway extending through it, patched with concrete on downstream side. About 15 ft. length of crest has been patched with concrete. Toe of ogee eroded and rough, minor cracks on downstream side with leaching deposits.	Concrete surfaces should be repaired to prevent further deterioration.
APPROACH CHANNEL	Rocks are piled up nearly to the crest on the upstream left side of the spillway.	Rocks should be removed.
DISCHARGE CHANNEL	Concrete apron downstream of spillway is in good condition. Downstream road bridge opening severely restricts flow.	
BRIDGE AND PIERS	Wing walls of spillway are cracked. Right wall has sloping cracks 1/2 in. wide and about 20 fet. long with 1/3 in. horizontal offset of the upper block. Left wing wall has 3/4 in. wide crack extending vertically from spillway crest to top of wall.	Wing walls are in poor shape and should be repaired. This may entail reforming the upper part of the right wall or completely replacing it.

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	Not Applicable	
APPROACH CHANNEL	Not Applicable	
DISCHARGE CHANNEL	Not Applicable	
BRIDGE AND PIERS	Not Applicable	
GATES AND OPERATION EQUIPMENT	Not Applicable	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	No part of the outlet works could be observed.	
INTAKE STRUCTURE	Intake structure submerged and could not be observed.	
OUTLET STRUCTURE	Gate valve and manhole housing it have been covered by 18 feet of road embankment material. Owner has been excavating this material but has been unable to locate the valve as yet.	The outlet pipe and control should be located as soon as possible.
OUTLET CHANNEL	Outlet pipe obscured by road embankment material.	
EMERGENCY GATE	The above-described outlet works is the emergency outlet.	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	
OBSERVATION WELLS	None	
WEIRS	None	
PIEZOMETERS	None	
OTHER	None	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Moderate to steep slopes, heavily wooded. Numerous residences surrounding lake.	
SEDIMENTATION	None. Some tree stumps exposed.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Bridge immediately downstream with 11.5' x 5.6' opening. Downstream of bridge channel is paved for 6' and then becomes natural channel, opening onto a broad floodplain area but becoming restricted by narrow channel further downstream. Small trees in drainage channel.	
SLOPES	Open, flat meadow below lined channel. Moderately steep slopes further downstream.	
APPROXIMATE NO. OF HOMES AND POPULATION	Three structures about 1,000 ft. downstream indicated on U.S.G.S. map. Major highway (Highway 23) 1,500 ft. downstream. Community of Butler further downstream.	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	"Apshawa Lake Dam:, Scale 1" = 40', by Newell C. Harrison, 1950. (See Plate 2) Present configuration represented on "High Crest Lake Dam, General Plan" (Plate 4).
REGIONAL VICINITY MAP	U.S.G.S. topographic map (Plate 1)
CONSTRUCTION HISTORY	Data available from correspondence in State files
TYPICAL SECTIONS OF DAM	"Apshawa Lake Dam", Cross section scale 1" = 5', Profile scale 1" = 4', by Newell C. Harrison, 1950. (Plate 2)
HYDROLOGIC/HYDRAULIC DATA	Information in State file on hydrology and sizing of spillway.
OUTLETS - PLAN	) Outlet profile shown on cross section (Plate 2)
- DETAILS	)
-CONSTRAINTS -DISCHARGE RATINGS	) None available)
RAINFALL/RESERVOIR RECORDS	None available.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
DESIGN REPORTS	None available
GEOLOGY REPORTS	None available
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available
POST-CONSTRUCTION SURVEYS OF DAM	None available
BORROW SOURCES	Not known

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
SPILLWAY-PLAN -SECTIONS -DETAILS	"Apshawa Lake Dam", Plan and profile of spillway, scale 1" = 5', by Newell C. Harrison, 1950. (Plate 3)
OPERATING EQUIPMENT PLANS & DETAILS	See Outlets - Plan
MONITORING SYSTEMS	None
MODIFICATIONS	No data available
HIGH POOL RECORDS	None available
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None available
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None reported

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
MAINTENANCE OPERATION RECORDS	None available

APPENDIX B

PHOTOGRAPHS

Photo 1 - Freshly surfaced roadway along crest of dam, looking east.
(December 3, 1978)

Photo 2 - Debris and trash covering downstream embankment.
(December 3, 1978)

Photo 3 - Exposed top of concrete core wall to right of pavement. (December 3, 1978)

Photo 4 - Cavitation of the crest of the spillway weir. (December 3, 1978)

Photo 5 - Leaching deposits (white areas) along cracks in spillway weir, and erosion of concrete at base of weir. (December 3, 1978)

Photo 6 - Rocks piled up behind spillway. Note crack in left wing wall. (December 3, 1978)

Photo 7 - Crack in right wing wall of spillway, looking downstream. (December 3, 1978)

Photo 8 - Bridge downstream of spillway, looking north toward spillway. (December 3, 1978)

Photo 9 - Downstream area. Stream channel hidden by brush on right.
(December 3, 1978)

APPENDIX C

REGIONAL GEOLOGY - PIEDMONT LOWLANDS

REGIONAL GEOLOGY - PIEDMONT LOWLANDS

Physiography

The Piedmont Lowlands Province of New Jersey lies northwest of a line approximately between Trenton and Perth Amboy and southeast of an approximate line between Milford on the Delaware River and Mahwah near the New York State border. Physiographically, the province is situated between the predominantly Precambrian age New Jersey Highlands Province to the northwest and the typically unconsolidated Creataceous age and younger sediments of the Coastal Plain Province to the southeast. (See Figure C-1).

Bedrock

The Piedmont Lowlands, encompassing about one-fifth of the state, is characterized by northwestward dipping bedrock composed of interbedded red shales, siltstones and sandstones of Triassic and Jurassic age and igneous basalt extrusions (lava flows) and diabase intrusions of Jurassic age. The sedimentary rocks have been eroded to a broad southeastward sloping piedmont plain. The northwest border of the province is a northeast-southwest trending fault zone (Ramapo Fault) which truncates the sedimentary beds. Total vertical displacement on the fault may reach 10,000 feet.

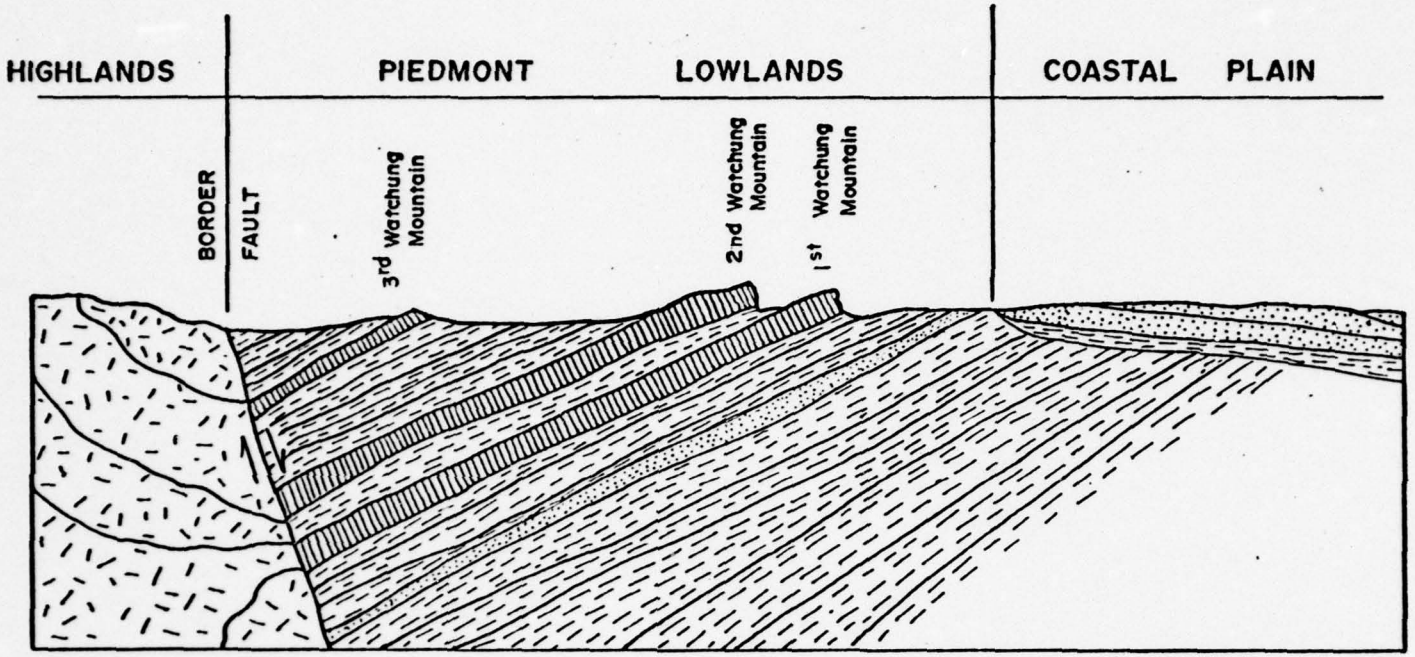
The gently rolling lowland topography of the piedmont lowlands is pierced by long asymetric ridges of hard

and resistant igneous rocks which were intruded into or on top of the sedimentary sequences. With the subsequent erosion of the softer sedimentary rocks, these igneous formations have been left standing, often in bold relief, up to 400 ft. above the surrounding plains. The igneous bodies composed of diabase and basalt form the Palisades along the Hudson River and the three Watchung Mountain ridges of the central Piedmont. The ridges are all steeper on the southeast with gentle dip slopes to the northwest.

Overburden

The Pleistocene Age Wisconsin continental glacier has smoothed and filled approximately the northern half of the province. The terminal moraine of the glacier extends from Perth Amboy to Summit then northwestward to Morris Plains. North of the morainal line the soils characteristically consist of glacial tills overlying the bedrock with scattered overlying stratified outwash deposits. At least three large glacial lakes occupied portions of the area north of the moraine at different periods, resulting in a relatively flat topography composed predominantly of silts and clays.

South of the terminal moraine, most of the overburden consists of alluvial deposits overlying a more highly developed weathered transition zone on top of the bedrock. Some highly weathered tills of pre-Wisconsin glaciation can be found on the top of intervalley ridges. Much of the alluvium is glacial outwash.



Pre-cambrian gneisses, schists and metasediments

Triassic and Jurassic shales, sandstones & siltstones

Lava (Basalt) flows

Cretaceous and younger age unconsolidated deposits

SCHEMATIC CROSS-SECTION OF
NEW JERSEY PIEDMONT LOWLANDS
PHYSIOGRAPHIC PROVINCE

JENNY / LEEDSHILL
JANUARY 1979

FIGURE C-1

APPENDIX D

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 0.57 SQ. MILES

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 632 FT (240 AF)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 635.5 FT (295 AF)

ELEVATION MAXIMUM DESIGN POOL: 636.8

ELEVATION TOP DAM: 635.5 FT

CREST: SPILLWAY

a. Elevation 632
b. Type CONCRETE OGEE
c. Width —
d. Length 45 FT
e. Location Spillover RIGHT ABUTMENT
f. Number and Type of Gates NONE

OUTLET WORKS:

a. Type 12" C.I. PIPE
b. Location NEAR THE LEFT ABUTMENT
c. Entrance inverts —
d. Exit inverts —
e. Emergency draindown facilities —

HYDROMETEOROLOGICAL GAGES: NONE

a. Type
b. Location
c. Records

MAXIMUM NON-DAMAGING DISCHARGE: 1125 CFS

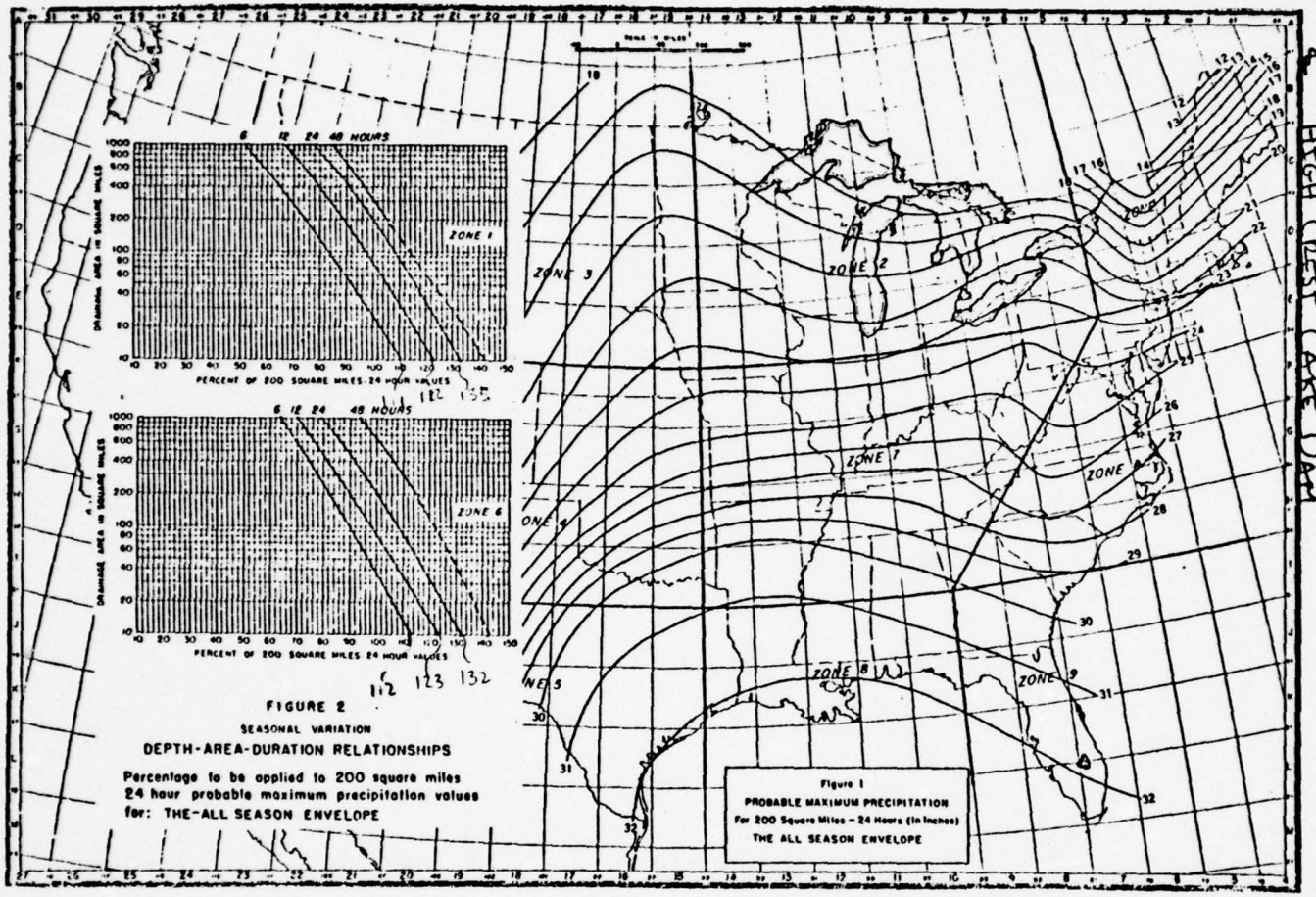


FIGURE 2

SEASONAL VARIATION

DEPTH-AREA-DURATION RELATIONSHIPS

Percentage to be applied to 200 square miles 24 hour probable maximum precipitation values for: THE-ALL SEASON ENVELOPE

Figure 1

PROBABLE MAXIMUM PRECIPITATION

For 200 Square Miles – 24 Hours (In Inches)

THE ALL SEASON ENVELOPE

1-D

HIGH CREST LAKE DAM

790217

302-03

CHAMPION LINE NO. 635-P LEEDS, HILL AND JEWETT, INC.

BY RBE DATE 731220 CLIENT N.J. SHEET NO. 1 OF 2

CHKD DATE JOB TIME OF CONCENTRATION JOB NO. 302

DATA

HIGH CREST

L = STREAM LENGTH FROM WATERSHED OUTLET TO THE MOST DISTANT RIDGE = 1.29 m

L_{CA} = STREAM LENGTH FROM BASIN CENTROID = 0.61 m

H = DIFF BETWEEN ELEV AT OUTLET AND ELEV AT MOST DISTANT POINT = 780 - 620 = 160

T_C = TIME OF CONCENTRATION OR TIME FOR WATER TO FLOW FROM THE MOST DISTANT POINT IN THE WATERSHED TO THE WATERSHED OUTLET

T_L = LAG TIME FROM CENTER OF EXCESS RAINFALL TO TIME OF PEAK. $= 0.6\,T_C$

METHOD 1

$$T_C = \frac{L^{1.15}}{7700\,H^{0.38}}$$

L IN FT
H IN FT

$$T_L = \frac{0.6\,L^{1.15}}{7700\,H^{0.38}}$$

METHOD 2

$$T_C = \left(\frac{11.9\,L^3}{H}\right)^{0.385}$$

L IN MILES
H IN FT.

$$T_L = 0.6\left(\frac{11.9\,L^3}{H}\right)^{0.385}$$

METHOD 3

$$T_L = C_T\left(\frac{L\,L_C}{S^{1/2}}\right)^{0.38}$$

S IN FT/MI $S = H/L = 2.35\%$

$$T_L = C_T\left(\frac{L\,L_C}{(H/L)^{1/2}}\right)^{0.38}$$

C_T = 1.2 MOUNTAIN
= (0.72) FOOTHILL
= 0.35 VALLEY DRAINAGE AREA

METHOD 4

$T_C = L/V$

$T_L = 0.6\,L/V$

V = AVG VELOCITY FROM CURVE OF V VS. AVG SLOPE
V = 2.6 fps

DAM	LAG IN HOURS METHODS				
	1	2	3	4	USE
HIGH CREST	0.3	0.3	0.3	0.4	0.3

RBE | 78 1220 302 | 2/2

D-3

LEEDS, HILL AND JEWETT, INC.

BY PBE DATE CLIENT N.J. DAM SAFETY SHEET NO. OF

CHKD. DATE JOB JOB NO. 302-03

REFERENCES

METHOD 1 - FROM "HANDBOOK OF APPLIED HYDROLOGY" BY CHOW McGRAW HILL PP 21-10, 11

METHOD 2 - FROM CALIFORNIA CULVERTS PRACTICE, CALIF HIGHWAYS AND PUBLIC WORKS, SEPT 1942 SEE USBR DESIGN OF SMALL DAMS PG. 71

METHOD 3 - FROM HYDROLOGY FOR ENGINEERS LINSLEY / KOHLER / PAULHUS 1975 PP 247-248

METHOD 4 - FROM U.S. NAVY - TECHNICAL PUBLICATION NAVDOCKS TP-PW-5 TABLE 8B, MARCH 1953 SEE USBR DESIGN OF SMALL DAMS PG. 70

TAILWATER RATING CURVE

ASSUME: BRIDGE CONTROLS TAILWATER

REFERENCE: USBR DESIGN OF SMALL DAM
FIG. B-12 / BOX CULVERTS WITH ENTRANCE CONTROL

ASSUME: WINGWALL FLARE BETWEEN 90° AND 15°
(USE COLUMN 2 FOR H/D)

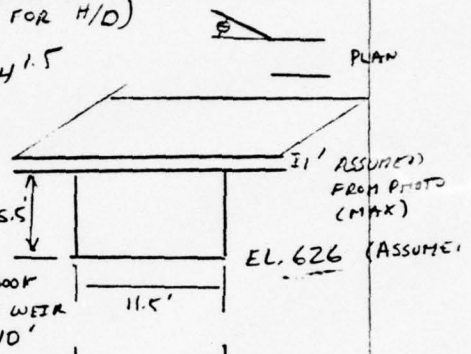
FOR FLOW OVER BRIDGE USE $Q = CLH^{1.5}$

WHERE:

L = 50'

C ≈ 2.6
SEE TABLE 5.3
KINGS HANDBOOK
BROADCRESTED WEIR
WIDTH 5-10'

D = 5.5
W = 11.5



H	ELEV	Q THROUGH BRIDGE H/D	Q THROUGH BRIDGE Q/W (CFS/FT)	Q THROUGH BRIDGE Q (CFS)	Q OVER BRIDGE	TOTAL Q CFS
2	628	0.36	7.0	80	0	80
3	629	0.55	13	150	0	150
5	631	0.91	29	330	0	330
5.5	631.5	1.0	33	380	0	380
6.5	632.5	1.18	44	510	0	510
7	633	1.27	47	540	45	585
8	634	1.45	55	630	240	870
10	636	1.82	65	750	850	1600
12	638	2.18	75	860	1680	2540
14	640	2.55	85	980	2670	3650

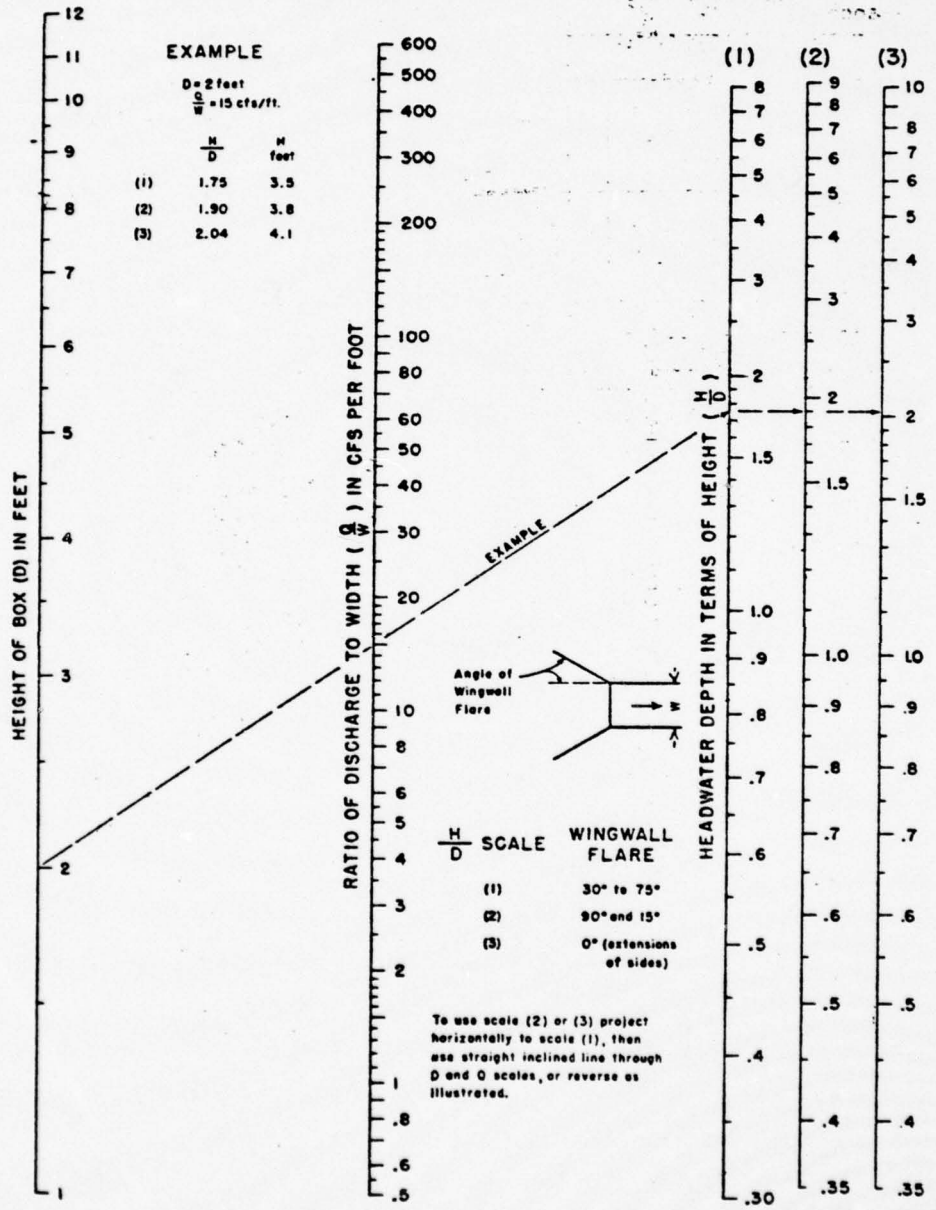


Figure 8–12. Headwater depth for box culverts with entrance control. (U.S. Bureau of Public Roads.) 288–D–2912.

RBE 302-03 | HIGH CREST | 790125

T.W. vs Q @ BRIDGE

P = 4
H_o = 2.16
C_o = 3.9
L = 45

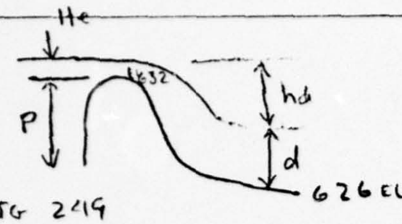


FIG 249 P/Ho

$h_d = 632 - 626 + H_e - d$

$h_d = 6 + H_e - d$

METHOD. FOR GIVEN Q, OBTAIN T.W. DEPTH d FROM FROM RATING CURVE FOR BRIDGE, BY TRIAL AND ERROR ASSUME A He THAT WILL Q WHEN CORRECTED FOR T.W. EFFECTS AND DIFFERING HEADS THAN THE ASSUMED HEAD

GIVEN ① Q (CFS)	T.W. CURVE ② d (FT)	ASSUMED → ③ H_e (FT)	④ $\frac{h_d + d}{H_e}$	⑤ h_d/H_e	⑥ % RED OF C	⑦ H_e/H_o	⑧ C_e/C_o	⑨ C_T (1-⑥)×⑧×3.8	⑩ Q (CFS)	
250	4.2	1.3	–	–	0	0.60	0.94	3.67	245	ok
500	6.4	2.0	4.0	0.80	0	0.97	0.99	3.86	490	✓
1000	8.1	3.2	2.88	0.25	8.5	1.53	1.06	3.79	976	✓
1500	9.8	4.4	2.36	0.14	19	2.04	1.12	3.54	1470	✓
2000	10.9	5.5	2.09	0.11	23	2.5	1.19	3.53	2047	✓
2500	12.0	6.5	1.92	0.08	32	3.01	1.26	3.34	2490	✓
3500	13.7	8.3	1.72	0.07	38	3.84	1.36	3.24	3490	✓
					↑ FIG 252		↑ FIG 250			

DESIGN OF SMALL DAMS

USBR

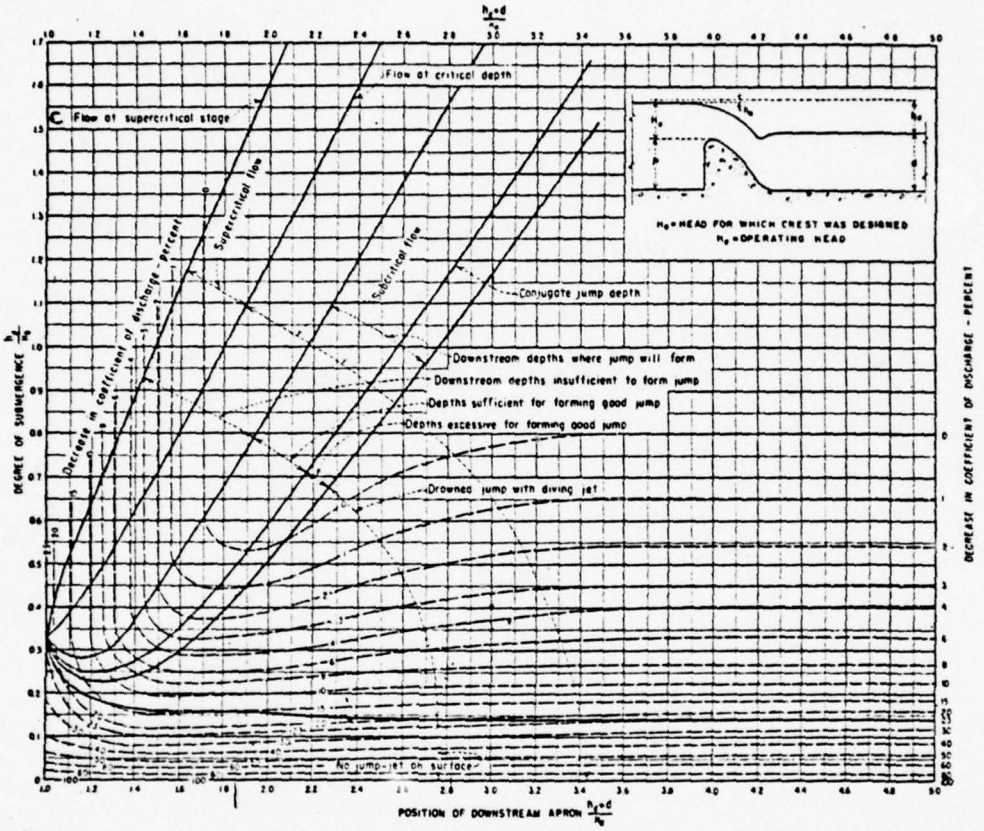


Figure 252. Effects of downstream influences on flow over weir crests. 288-D-2412.

Figure 251 is used to correct the discharge coefficient for the inclined upstream slope. For a 1:1 slope and a value of 0.41 for $\frac{P}{H_e}$, the ratio of $\frac{C_{inclined}}{C_{vertical}}$ is 1.018. Then, $C_i = 1.018 \times 3.77 = 3.84$.

Next, the relationships of $\frac{h_d+d}{H_e}$ and $\frac{h_v}{H_e}$ are evaluated to determine the downstream effects. The value of $\frac{h_d+d}{H_e}$ is approximately $\frac{6.89}{4.89} = 1.41$. From figure 252 for an $\frac{h_d+d}{H_e}$ value of 1.41, the value of $\frac{h_d}{H_e}$ at supercritical flow is 0.91. If supercritical flow prevails, h_d should be equal to 0.91 $H_e = 0.91 \times 4.89 = 4.44$, and d should be equal to 6.89–4.44=2.45 feet. With the indicated unit discharge of approximately 41 second-feet, the downstream velocity will be approximately $\frac{41}{2.45} = 16.7$ feet per second, and the velocity head, h_v, will be equal to $\frac{16.7^2}{64.4} =$ 4.4 feet. The closeness of the values of h_d and h_v verifies that the flow is supercritical. From

D-9

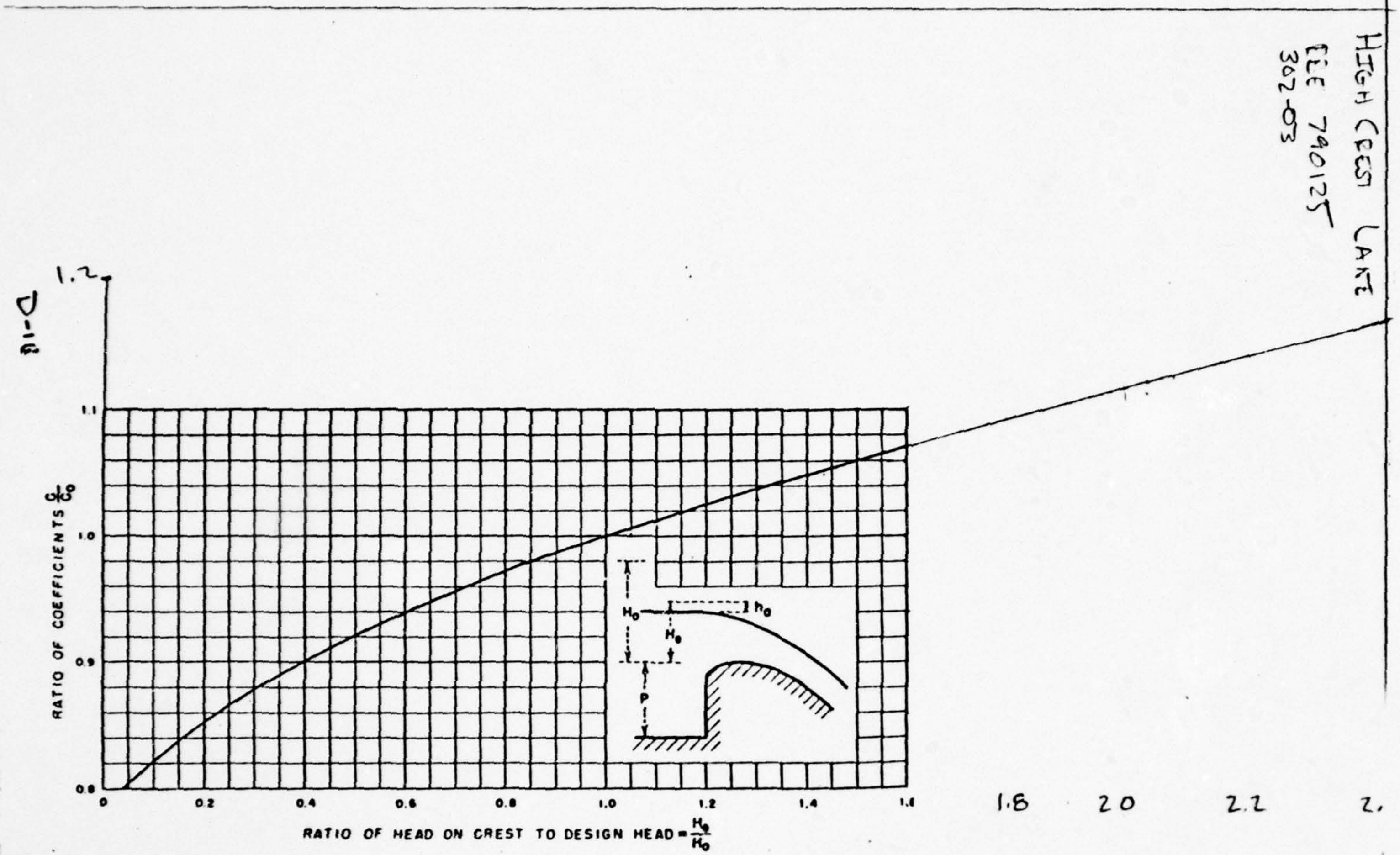


Figure 250. Coefficient of discharge for other than the design head. 288—D—2410.

KBE 19C125	HIGH CREST	302-03

SPWY RATING CURVE

RBE 740207	HIGH CREST LAKE	302-03

LOCATION MAP OF CROSS-SECTIONS USED IN ROUTING CALCULATIONS

TABLE 5-6. VALUES OF THE ROUGHNESS COEFFICIENT n (*continued*)

Type of channel and description	Minimum	Normal	Maximum
C. EXCAVATED OR DREDGED			
a. Earth, straight and uniform			
1. Clean, recently completed	0.016	0.018	0.020
2. Clean, after weathering	0.018	0.022	0.025
3. Gravel, uniform section, clean	0.022	0.025	0.030
4. With short grass, few weeds	0.022	0.027	0.033
b. Earth, winding and sluggish			
1. No vegetation	0.023	0.025	0.030
2. Grass, some weeds	0.025	0.030	0.033
3. Dense weeds or aquatic plants in deep channels	0.030	0.035	0.040
4. Earth bottom and rubble sides	0.028	0.030	0.035
5. Stony bottom and weedy banks	0.025	0.035	0.040
6. Cobble bottom and clean sides	0.030	0.040	0.050
c. Dragline-excavated or dredged			
1. No vegetation	0.025	0.028	0.033
2. Light brush on banks	0.035	0.050	0.060
d. Rock cuts			
1. Smooth and uniform	0.025	0.035	0.040
2. Jagged and irregular	0.035	0.040	0.050
e. Channels not maintained, weeds and brush uncut			
1. Dense weeds, high as flow depth	0.050	0.080	0.120
2. Clean bottom, brush on sides	0.040	0.050	0.080
3. Same, highest stage of flow	0.045	0.070	0.110
4. Dense brush, high stage	0.080	0.100	0.140
D. NATURAL STREAMS			
D-1. Minor streams (top width at flood stage <100 ft)			
a. Streams on plain			
1. Clean, straight, full stage, no rifts or deep pools	0.025	0.030	0.033
2. Same as above, but more stones and weeds	0.030	0.035	0.040
3. Clean, winding, some pools and shoals	0.033	0.040	0.045
4. Same as above, but some weeds and stones	0.035	0.045	0.050
5. Same as above, lower stages, more ineffective slopes and sections	0.040	0.048	0.055
6. Same as 4, but more stones	0.045	0.050	0.060
7. Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
8. Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150

STATION 3 | 4

TABLE 5-6. VALUES OF THE ROUGHNESS COEFFICIENT n (*continued*)

Type of channel and description	Minimum	Normal	Maximum
b. Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages			
1. Bottom: gravels, cobbles, and few boulders	0.030	0.040	0.050
2. Bottom: cobbles with large boulders	0.040	0.050	0.070
D-2. Flood plains			
a. Pasture, no brush			
1. Short grass	0.025	0.030	0.035
2. High grass	0.030	0.035	0.050
b. Cultivated areas			
1. No crop	0.020	0.030	0.040
2. Mature row crops	0.025	0.035	0.045
3. Mature field crops	0.030	0.040	0.050
c. Brush			
1. Scattered brush, heavy weeds	0.035	0.050	0.070
2. Light brush and trees, in winter	0.035	0.050	0.060
3. Light brush and trees, in summer	0.040	0.060	0.080
4. Medium to dense brush, in winter	0.045	0.070	0.110
5. Medium to dense brush, in summer	0.070	0.100	0.160
d. Trees			
1. Dense willows, summer, straight	0.110	0.150	0.200
2. Cleared land with tree stumps, no sprouts	0.030	0.040	0.050
3. Same as above, but with heavy growth of sprouts	0.050	0.060	0.080
4. Heavy stand of timber, a few down trees, little undergrowth, flood stage below branches	0.080	0.100	0.120
5. Same as above, but with flood stage reaching branches	0.100	0.120	0.160
D-3. Major streams (top width at flood stage >100 ft). The n value is less than that for minor streams of similar description, because banks offer less effective resistance.			
a. Regular section with no boulders or brush	0.025	.....	0.060
b. Irregular and rough section	0.035	.....	0.100

OPEN-CHANNEL HYDRAULICS

STATION 4

VENTI CHOW

LEEDS, HILL AND JEWETT, INC.

BY RBE DATE 7/31/80 CLIENT NEW JERSEY SHEET NO. OF

CHKD. DATE JOB JOB NO. 202-01

HIGH CREST LAKE

CHANNEL CROSS-SECTIONS [1]

STATION	DISTANCE DOWNSTREAM OF DAM (FT)	MANNINGS "n" LEFT OVER-BANK	MANNINGS "n" MAIN CHANNEL	MANNINGS "n" RIGHT OVER-BANK	CHANNEL TOPWIDTH (FT)	MAX ELEV. (FT)	REACH LENGTH (FT)	ENERGY GRADE LINE SLOPE	X OR Y	1	2	3	4	5	6	7	8
										X OR Y (FT)							
2 - BELOW DAM																	
4	1200	0.10 [3]	0.045 [3]	0.10 [4]	520	560	1060	0.076	X	0	100	290	229	310	310	500	700
									Y	560	540	522	520	520	522	540	560
5 (NOT USED)	6400	0.05 [5]	0.04	0.05 [5]	410	440	5200	0.021	X	0	150	325	328	425	425	650	750
									Y	440	420	412	410	410	412	420	440
3	150	0.08 [5]	0.045	0.08 [5]	600	640	150	0.08	X	0	200	525	575	550	550	825	900
									Y	640	620	601	600	600	601	620	640

[1] LOOKING DOWNSTREAM

[2] VENTE CHOW OPEN CHANNEL FLOW TABLE 5-6

[3] WINDING MINOR STREAM (<100') ROCKS AND WEEDS

[4] HEAVY TREES, LITTLE UNDERGROWTH

[5] URBAN AREA

[6] MAJOR RIVER >100'

[7] UNIT ESTIMATE

A-1-F

DRAWDOWN CALCULATIONS

12" CAST IRON PIPE

USE ORIFICE EQUATION

$$Q = CA\sqrt{2gH'}$$

H' = AVG. H BETWEEN TWO ELEVATIONS TO COMPUTE Δ TIME.

C = DISCHARGE COEFF

ASSUME: 1) C = 0.6
2) NO INFLOWS TO LAKE
3) NO TAILWATER EFFECTS

$$Q = 0.6\left(\frac{\pi}{4}\left(\frac{12}{12}\right)^2\right)\sqrt{2g}\sqrt{H}$$

$$Q = 3.78\,H^{1/2}$$

$$\Delta S/\Delta t = 3.78\,H^{1/2}$$

$$\Delta t = (\Delta S/3.78\,H^{1/2})\,(43560\ FT^3/AF)\,(1/3600\ SEC/HR)$$

$$\Delta t = 3.2\,\Delta S\,H^{-1/2}$$

ELEV. FT	STO AF	ΔSTO AF	MEAN HEAD (FT)	Δ TIME HR	Σ TIME HR
632	240				
		70	17	54.3	
630	170				54.3
		60	15	49.5	
628	110				103.8
		60	12.5	54.3	
625	50				158.1
		40	8.5	43.9	
620	10				202.0
		10	3	18.5	
614	0				220.5

DRAWDOWN TIME = 220.5 HR / 24 HR/DAY = 9.2 DAYS

```
*********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  25 SEP 78
*********************************
A1      NEW JERSEY DAM SAFETY - HIGH CREST LAKE DAM  I.D. 00225
A2      HYDRAULIC-HYDROLOGIC ANALYSIS   302-03
A3      PROBABLE MAXIMUM FLOOD                                        -RBE-
B    288       0       5       0       0       0       0       0       0       0
B1     5
J      1       4       1
J1  0.25     0.5    0.75     1.0
K      0       1                                       1
K1                          INFLOW HYDROGRAPH TO RESERVOIR
M      1       2     0.6             0.6                               1
P           22.1     111     123     133
T                                              1.0     0.1
W2           0.3
X     -1    -.05     2.0
K      1       2                                       1
K1                          ROUTED FLOWS THROUGH RESERVOIR
Y                              1       1
Y1     1                                       240      -1
Y4   632   633.3     634   635.2   636.4   637.5   638.5   640.3
Y5     0     250     500    1000    1500    2000    2500    3500
$S     0      10      50     110     240     285     370     470     820
$E   614     620     625     628     632     633     635     637     640
$$   632
$D 635.5     3.1     1.5     190
K      1       3                                       1
K1      CHANNEL ROUTING -MODIFIED PULS- STATION 2 TO 3
Y                              1       1
Y1     1
Y6  0.08   0.045    0.08     600     640     150    0.00
Y7     0     640     200     620     525     601     525     600     550     600
Y7   550     601     825     620     900     640
K      1       4                                       1
K1      CHANNEL ROUTING -MODIFIED PULS- STATION 3 TO 4
Y                              1       1
Y1     1
Y6  0.10   0.045    0.10     520     560    1050    0.00
Y7     0     560     100     540     290     522     290     520     310     520
Y7   310     522     500     540     700     540
K     99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

```
RUNOFF HYDROGRAPH AT        1
ROUTE HYDROGRAPH TO         2
ROUTE HYDROGRAPH TO         3
ROUTE HYDROGRAPH TO         4
END OF NETWORK
```

NEW JERSEY DAM SAFETY - HIGH CREST LAKE DAM I.D. 00225
HYDRAULIC-HYDROLOGIC ANALYSIS 332-83
PROBABLE MAXIMUM FLOOD -RBE-

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
248	0	5	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 4 LRTIO= 1
RTIOS= .25 .50 .75 1.00

********** *********** ********** ********* **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH TO RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUNG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.60	0.00	.60	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.10	111.00	123.00	133.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .400

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.30	0.00	1.00	0.00	0.00	1.00	1.00	.10	0.00	0.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .30

RECESSION DATA
STRTQ= -1.00 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 20 END-OF-PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .30 VOL= 1.00

119.	383.	727.	948.	779.	609.	387.	259.	177.	118.
80.	54.	36.	24.	16.	11.	8.	5.	3.	1.

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	END-OF-PERIOD FLOW MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	1.	1.01	12.05	145	.16	.16	.01	114.
1.01	.10	2	.01	0.00	.01	1.	1.01	12.10	146	.16	.16	.01	165.
1.01	.15	3	.01	0.00	.01	0.	1.01	12.15	147	.16	.16	.01	263.
1.01	.20	4	.01	0.00	.01	0.	1.01	12.20	148	.16	.16	.01	376.
1.01	.25	5	.01	0.00	.01	0.	1.01	12.25	149	.16	.16	.01	481.
1.01	.30	6	.01	0.00	.01	0.	1.01	12.30	150	.16	.16	.01	563.
1.01	.35	7	.01	0.00	.01	0.	1.01	12.35	151	.16	.16	.01	614.
1.01	.40	8	.01	0.00	.01	0.	1.01	12.40	152	.16	.16	.01	649.
1.01	.45	9	.01	0.00	.01	0.	1.01	12.45	153	.16	.16	.01	673.
1.01	.50	10	.01	0.00	.01	0.	1.01	12.50	154	.16	.16	.01	689.
1.01	.55	11	.01	0.00	.01	0.	1.01	12.55	155	.16	.16	.01	700.
1.01	1.00	12	.01	0.00	.01	0.	1.01	13.00	156	.16	.16	.01	707.
1.01	1.05	13	.01	0.00	.01	0.	1.01	13.05	157	.20	.19	.01	715.
1.01	1.10	14	.01	0.00	.01	0.	1.01	13.10	158	.20	.19	.01	721.
1.01	1.15	15	.01	0.00	.01	0.	1.01	13.15	159	.20	.19	.01	727.
1.01	1.20	16	.01	0.00	.01	0.	1.01	13.20	160	.20	.19	.01	786.
1.01	1.25	17	.01	0.00	.01	0.	1.01	13.25	161	.20	.19	.01	813.
1.01	1.30	18	.01	0.00	.01	0.	1.01	13.30	162	.20	.19	.01	834.
1.01	1.35	19	.01	0.00	.01	0.	1.01	13.35	163	.20	.19	.01	847.
1.01	1.40	20	.01	0.00	.01	0.	1.01	13.40	164	.20	.19	.01	855.
1.01	1.45	21	.01	0.00	.01	0.	1.01	13.45	165	.20	.19	.01	861.
1.01	1.50	22	.01	0.00	.01	0.	1.01	13.50	166	.20	.19	.01	865.
1.01	1.55	23	.01	0.00	.01	0.	1.01	13.55	167	.20	.19	.01	867.
1.01	2.00	24	.01	0.00	.01	0.	1.01	14.00	168	.20	.19	.01	869.
1.01	2.05	25	.01	0.00	.01	0.	1.01	14.05	169	.25	.24	.01	876.
1.01	2.10	26	.01	0.00	.01	0.	1.01	14.10	170	.25	.24	.01	896.
1.01	2.15	27	.01	0.00	.01	0.	1.01	14.15	171	.25	.24	.01	932.
1.01	2.20	28	.01	0.00	.01	0.	1.01	14.20	172	.25	.24	.01	974.
1.01	2.25	29	.01	0.00	.01	0.	1.01	14.25	173	.25	.24	.01	1012.
1.01	2.30	30	.01	0.00	.01	0.	1.01	14.30	174	.25	.24	.01	1042.
1.01	2.35	31	.01	0.00	.01	0.	1.01	14.35	175	.25	.24	.01	1062.
1.01	2.40	32	.01	0.00	.01	0.	1.01	14.40	176	.25	.24	.01	1074.
1.01	2.45	33	.01	0.00	.01	0.	1.01	14.45	177	.25	.24	.01	1083.
1.01	2.50	34	.01	0.00	.01	0.	1.01	14.50	178	.25	.24	.01	1089.
1.01	2.55	35	.01	0.00	.01	0.	1.01	14.55	179	.25	.24	.01	1093.
1.01	3.00	36	.01	0.00	.01	0.	1.01	15.00	180	.25	.24	.01	1095.
1.01	3.05	37	.01	0.00	.01	0.	1.01	15.05	181	.15	.14	.01	1086.
1.01	3.10	38	.01	0.00	.01	0.	1.01	15.10	182	.30	.29	.01	1066.
1.01	3.15	39	.01	0.00	.01	0.	1.01	15.15	183	.30	.29	.01	1056.
1.01	3.20	40	.01	0.00	.01	0.	1.01	15.20	184	.45	.44	.01	1101.
1.01	3.25	41	.01	0.00	.01	0.	1.01	15.25	185	.52	.51	.01	1219.
1.01	3.30	42	.01	0.00	.01	0.	1.01	15.30	186	1.27	1.26	.01	1502.
1.01	3.35	43	.01	0.00	.01	0.	1.01	15.35	187	2.09	2.08	.01	2114.
1.01	3.40	44	.01	0.00	.01	0.	1.01	15.40	188	.82	.81	.01	3037.
1.01	3.45	45	.01	0.00	.01	0.	1.01	15.45	189	.52	.51	.01	3915.
1.01	3.50	46	.01	0.00	.01	0.	1.01	15.50	190	.45	.44	.01	4266.
1.01	3.55	47	.01	0.00	.01	0.	1.01	15.55	191	.30	.29	.01	4040.
1.01	4.00	48	.01	0.00	.01	0.	1.01	16.00	192	.30	.29	.01	3587.
1.01	4.05	49	.01	0.00	.01	0.	1.01	16.05	193	.23	.22	.01	2948.
1.01	4.10	50	.01	0.00	.01	0.	1.01	16.10	194	.23	.22	.01	2434.
1.01	4.15	51	.01	0.00	.01	0.	1.01	16.15	195	.23	.22	.01	2128.
1.01	4.20	52	.01	0.00	.01	0.	1.01	16.20	196	.23	.22	.01	1715.
1.01	4.25	53	.01	0.00	.01	0.	1.01	16.25	197	.23	.22	.01	1498.
1.01	4.30	54	.01	0.00	.01	0.	1.01	16.30	198	.23	.22	.01	1339.
1.01	4.35	55	.01	0.00	.01	0.	1.01	16.35	199	.23	.22	.01	1236.
1.01	4.40	56	.01	0.00	.01	0.	1.01	16.40	200	.23	.22	.01	1167.
1.01	4.45	57	.01	0.00	.01	0.	1.01	16.45	201	.23	.22	.01	1120.
1.01	4.50	58	.01	0.00	.01	0.	1.01	16.50	202	.23	.22	.01	1089.
1.01	4.55	59	.01	0.00	.01	0.	1.01	16.55	203	.23	.22	.01	1069.
1.01	5.00	60	.01	0.00	.01	0.	1.01	17.00	204	.23	.22	.01	1054.
1.01	5.05	61	.01	0.00	.01	0.	1.01	17.05	205	.18	.17	.01	1036.
1.01	5.10	62	.01	0.00	.01	0.	1.01	17.10	206	.18	.17	.01	1039.
1.01	5.15	63	.01	0.00	.01	0.	1.01	17.15	207	.18	.17	.01	988.
1.01	5.20	64	.01	0.00	.01	0.	1.01	17.20	208	.18	.17	.01	923.
1.01	5.25	65	.01	0.00	.01	0.	1.01	17.25	209	.18	.17	.01	885.
1.01	5.30	66	.01	0.00	.01	0.	1.01	17.30	210	.18	.17	.01	855.
1.01	5.35	67	.01	0.00	.01	0.	1.01	17.35	211	.18	.17	.01	836.
1.01	5.40	68	.01	0.00	.01	0.	1.01	17.40	212	.18	.17	.01	823.
1.01	5.45	69	.01	0.00	.01	0.	1.01	17.45	213	.18	.17	.01	814.
1.01	5.50	70	.01	0.00	.01	0.	1.01	17.50	214	.18	.17	.01	808.
1.01	5.55	71	.01	0.00	.01	0.	1.01	17.55	215	.18	.17	.01	804.
1.01	6.00	72	.01	0.00	.01	0.	1.01	18.00	216	.18	.17	.01	802.
1.01	6.05	73	.03	0.00	.03	0.	1.01	18.05	217	.01	.01	.01	781.
1.01	6.10	74	.03	0.00	.03	0.	1.01	18.10	218	.01	.01	.01	716.
1.01	6.15	75	.03	0.00	.03	0.	1.01	18.15	219	.01	.01	.01	595.
1.01	6.20	76	.03	0.00	.03	0.	1.01	18.20	220	.01	.01	.01	499.
1.01	6.25	77	.03	0.00	.03	0.	1.01	18.25	221	.01	.01	.01	434.

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1.01	6.30	78	.03	0.00	.03	0.	1.01	18.30	222	.01	.01	.01	225.
1.01	6.35	79	.03	0.00	.03	0.	1.01	18.35	223	.01	.01	.01	204.
1.01	6.40	80	.03	0.00	.03	0.	1.01	18.40	224	.01	.01	.01	188.
1.01	6.45	81	.03	0.00	.03	0.	1.01	18.45	225	.01	.01	.01	175.
1.01	6.50	82	.03	.00	.03	0.	1.01	18.50	226	.01	.01	.01	164.
1.01	6.55	83	.03	.02	.01	3.	1.01	18.55	227	.01	.01	.01	153.
1.01	7.00	84	.03	.02	.01	12.	1.01	19.00	228	.01	.01	.01	143.
1.01	7.05	85	.03	.02	.01	27.	1.01	19.05	229	.01	.01	.01	133.
1.01	7.10	86	.03	.02	.01	45.	1.01	19.10	230	.01	.01	.01	124.
1.01	7.15	87	.03	.02	.01	61.	1.01	19.15	231	.01	.01	.01	116.
1.01	7.20	88	.03	.02	.01	74.	1.01	19.20	232	.01	.01	.01	108.
1.01	7.25	89	.03	.02	.01	82.	1.01	19.25	233	.01	.01	.01	101.
1.01	7.30	90	.03	.02	.01	87.	1.01	19.30	234	.01	.01	.01	94.
1.01	7.35	91	.03	.02	.01	91.	1.01	19.35	235	.01	.01	.01	88.
1.01	7.40	92	.03	.02	.01	93.	1.01	19.40	236	.01	.01	.01	82.
1.01	7.45	93	.03	.02	.01	95.	1.01	19.45	237	.01	.01	.01	76.
1.01	7.50	94	.03	.02	.01	96.	1.01	19.50	238	.01	.01	.01	71.
1.01	7.55	95	.03	.02	.01	97.	1.01	19.55	239	.01	.01	.01	66.
1.01	8.00	96	.03	.02	.01	97.	1.01	20.00	240	.01	.01	.01	62.
1.01	8.05	97	.03	.02	.01	98.	1.01	20.05	241	.01	.01	.01	58.
1.01	8.10	98	.03	.02	.01	98.	1.01	20.10	242	.01	.01	.01	54.
1.01	8.15	99	.03	.02	.01	98.	1.01	20.15	243	.01	.01	.01	50.
1.01	8.20	100	.01	.02	.01	98.	1.01	20.20	244	.01	.01	.01	47.
1.01	8.25	101	.03	.02	.01	98.	1.01	20.25	245	.01	.01	.01	44.
1.01	8.30	102	.03	.02	.01	98.	1.01	20.30	246	.01	.01	.01	41.
1.01	8.35	103	.03	.02	.01	98.	1.01	20.35	247	.01	.01	.01	38.
1.01	8.40	104	.03	.02	.01	98.	1.01	20.40	248	.01	.01	.01	36.
1.01	8.45	105	.03	.02	.01	98.	1.01	20.45	249	.01	.01	.01	33.
1.01	8.50	106	.03	.02	.01	98.	1.01	20.50	250	.01	.01	.01	31.
1.01	8.55	107	.03	.02	.01	98.	1.01	20.55	251	.01	.01	.01	30.
1.01	9.00	108	.03	.02	.01	98.	1.01	21.00	252	.01	.01	.01	30.
1.01	9.05	109	.03	.02	.01	98.	1.01	21.05	253	.01	.01	.01	30.
1.01	9.10	110	.03	.02	.01	98.	1.01	21.10	254	.01	.01	.01	30.
1.01	9.15	111	.03	.02	.01	98.	1.01	21.15	255	.01	.01	.01	30.
1.01	9.20	112	.03	.02	.01	98.	1.01	21.20	256	.01	.01	.01	30.
1.01	9.25	113	.03	.02	.01	98.	1.01	21.25	257	.01	.01	.01	30.
1.01	9.30	114	.03	.02	.01	98.	1.01	21.30	258	.01	.01	.01	30.
1.01	9.35	115	.03	.02	.01	98.	1.01	21.35	259	.01	.01	.01	30.
1.01	9.40	116	.03	.02	.01	98.	1.01	21.40	260	.01	.01	.01	30.
1.01	9.45	117	.03	.02	.01	98.	1.01	21.45	261	.01	.01	.01	30.
1.01	9.50	118	.03	.02	.01	98.	1.01	21.50	262	.01	.01	.01	30.
1.01	9.55	119	.03	.02	.01	98.	1.01	21.55	263	.01	.01	.01	30.
1.01	10.00	120	.03	.02	.01	98.	1.01	22.00	264	.01	.01	.01	30.
1.01	10.05	121	.03	.02	.01	98.	1.01	22.05	265	.01	.01	.01	30.
1.01	10.10	122	.03	.02	.01	98.	1.01	22.10	266	.01	.01	.01	30.
1.01	10.15	123	.03	.02	.01	98.	1.01	22.15	267	.01	.01	.01	30.
1.01	10.20	124	.03	.02	.01	98.	1.01	22.20	268	.01	.01	.01	30.
1.01	10.25	125	.03	.02	.01	98.	1.01	22.25	269	.01	.01	.01	30.
1.01	10.30	126	.03	.02	.01	98.	1.01	22.30	270	.01	.01	.01	30.
1.01	10.35	127	.03	.02	.01	98.	1.01	22.35	271	.01	.01	.01	30.
1.01	10.40	128	.03	.02	.01	98.	1.01	22.40	272	.01	.01	.01	30.
1.01	10.45	129	.03	.02	.01	98.	1.01	22.45	273	.01	.01	.01	30.
1.01	10.50	130	.03	.02	.01	98.	1.01	22.50	274	.01	.01	.01	30.
1.01	10.55	131	.03	.02	.01	98.	1.01	22.55	275	.01	.01	.01	30.
1.01	11.00	132	.03	.02	.01	98.	1.01	23.00	276	.01	.01	.01	30.
1.01	11.05	133	.03	.02	.01	98.	1.01	23.05	277	.01	.01	.01	30.
1.01	11.10	134	.03	.02	.01	98.	1.01	23.10	278	.01	.01	.01	30.
1.01	11.15	135	.03	.02	.01	98.	1.01	23.15	279	.01	.01	.01	30.
1.01	11.20	136	.03	.02	.01	98.	1.01	23.20	280	.01	.01	.01	30.
1.01	11.25	137	.03	.02	.01	98.	1.01	23.25	281	.01	.01	.01	30.
1.01	11.30	138	.03	.02	.01	98.	1.01	23.30	282	.01	.01	.01	30.
1.01	11.35	139	.03	.02	.01	98.	1.01	23.35	283	.01	.01	.01	30.
1.01	11.40	140	.03	.02	.01	98.	1.01	23.40	284	.01	.01	.01	30.
1.01	11.45	141	.03	.02	.01	98.	1.01	23.45	285	.01	.01	.01	30.
1.01	11.50	142	.03	.02	.01	98.	1.01	23.50	286	.01	.01	.01	30.
1.01	11.55	143	.03	.02	.01	98.	1.01	23.55	287	.01	.01	.01	30.
1.01	12.00	144	.03	.02	.01	98.	1.02	0.00	288	.01	.01	.01	30.
									SUM	23.51	26.80	2.72	97816.
										(597.)(	528.)(	69.)(	2769.8M)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4266.	1207.	340.	340.	97803.
CMS	121.	34.	10.	10.	2769.
INCHES		10.72	21.06	21.06	21.06
MM		475.43	534.93	534.93	534.93
AC-FT		599.	674.	674.	674.
THOUS CU M		738.	831.	831.	831.

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HYDROGRAPH AT STA 1 FOR PLAN 1, RTIO 4

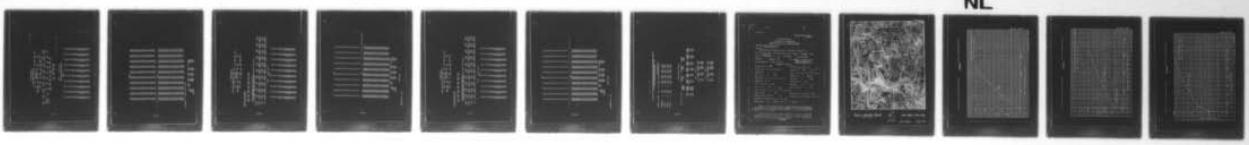
1.	1.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	3.	12.	27.	45.	61.	74.	82.	87.
91.	93.	95.	96.	97.	97.	98.	98.	98.	98.
98.	98.	98.	98.	98.	98.	98.	98.	98.	98.
98.	98.	98.	98.	98.	98.	98.	98.	98.	98.
98.	98.	98.	98.	98.	98.	98.	98.	98.	98.
98.	98.	98.	98.	98.	98.	98.	98.	98.	98.
98.	98.	98.	98.	114.	165.	263.	376.	481.	563.
614.	649.	673.	689.	700.	707.	715.	731.	757.	786.
813.	834.	847.	855.	861.	865.	867.	869.	876.	896.
932.	974.	1012.	1042.	1062.	1074.	1083.	1089.	1093.	1095.
1086.	1069.	1056.	1101.	1219.	1502.	2119.	3037.	3915.	4266.
4094.	3587.	2949.	2434.	2028.	1715.	1494.	1339.	1236.	1167.
1127.	1083.	1069.	1054.	1036.	1009.	968.	925.	885.	855.
836.	823.	814.	808.	834.	802.	781.	716.	555.	455.
326.	225.	232.	188.	175.	164.	153.	143.	133.	124.
116.	108.	101.	94.	88.	82.	76.	71.	66.	62.
58.	54.	50.	47.	44.	41.	38.	36.	33.	31.
30.	30.	30.	30.	30.	30.	30.	30.	30.	30.
30.	30.	30.	30.	30.	30.	30.	30.	30.	30.
30.	30.	30.	30.	30.	30.	30.	30.	30.	30.
30.	30.	30.	30.	30.	30.	30.	30.		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4266.	1207.	340.	340.	97803.
CFS	121.	34.	10.	10.	2769.
INCHES		18.72	21.06	21.06	21.06
MM		475.43	534.93	534.93	534.93
AC-FT		599.	674.	674.	674.
THOUS CU M		738.	831.	831.	831.

AD-A069 940 NEW JERSEY STATE DEPT OF ENVIRONMENTAL PROTECTION TRENTON F/G 13/2
NATIONAL DAM SAFETY PROGRAM. HIGH CREST LAKE DAM (NJ 00225), PA--ETC(U)
MAY 79 R J JENNY DACW61-78-C-0124

UNCLASSIFIED NL

2 OF 2
AD
A069940



END
DATE FILMED
7-79
DDC

HYDROGRAPH ROUTING

ROUTED FLOWS THROUGH RESERVOIR

ISTAQ	ICCMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	240.	-1

STAGE	632.00	633.30	634.00	635.20	636.40	637.50	638.50	640.30	
FLOW	0.00	250.00	500.00	1000.00	1500.00	2000.00	2500.00	3500.00	
CAPACITY=	0.	10.	50.	110.	240.	285.	370.	470.	620.
ELEVATION=	614.	620.	625.	628.	632.	633.	635.	637.	640.

CREL	SPWID	COQW	EXPW	ELEVL	COOL	CAREA	EXPL
632.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
635.5	3.1	1.5	180.

STATION 2, PLAN 1, RATIO 4

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	3.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	3.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	2.	3.	5.	7.	10.
12.	14.	16.	19.	21.	23.	25.	27.	30.	32.
33.	35.	37.	39.	41.	42.	44.	45.	47.	48.
53.	51.	53.	54.	55.	57.	58.	59.	60.	61.
62.	63.	64.	65.	66.	67.	68.	69.	70.	71.
71.	72.	73.	74.	74.	75.	76.	76.	77.	78.
79.	79.	79.	80.	81.	82.	86.	93.	103.	115.
127.	143.	159.	173.	188.	204.	219.	235.	251.	268.
313.	338.	367.	394.	420.	445.	469.	491.	515.	539.
563.	589.	615.	642.	669.	695.	720.	743.	766.	787.
887.	824.	839.	855.	875.	906.	958.	1049.	1212.	1544.
1919.	2228.	2405.	2455.	2416.	2322.	2201.	2072.	1947.	1835.
1735.	1647.	1573.	1504.	1446.	1395.	1348.	1303.	1260.	1221.
1186.	1155.	1133.	1112.	1095.	1078.	1062.	1045.	1023.	995.
962.	923.	879.	834.	791.	750.	712.	675.	640.	606.
575.	545.	516.	490.	468.	446.	425.	406.	387.	369.
351.	335.	319.	304.	289.	275.	262.	250.	243.	237.
239.	224.	218.	212.	207.	201.	196.	191.	186.	182.
177.	173.	169.	165.	161.	157.	154.	150.	146.	143.
140.	137.	134.	130.	128.	125.	122.	119.	117.	114.
112.	169.	107.	105.	103.	101.	98.	96.		

STORAGE

240.	240.	240.	240.	240.	240.	240.	240.	240.	240.
240.	240.	240.	240.	240.	240.	240.	240.	240.	240.
240.	240.	240.	240.	240.	240.	240.	240.	240.	240.
240.	240.	240.	240.	240.	240.	240.	240.	240.	240.
240.	240.	240.	240.	240.	240.	240.	240.	240.	240.
240.	240.	240.	240.	240.	240.	240.	240.	240.	240.
240.	240.	240.	240.	240.	240.	240.	240.	240.	240.
240.	240.	240.	240.	240.	240.	240.	240.	240.	240.
240.	240.	240.	240.	240.	240.	241.	241.	242.	242.
243.	243.	244.	244.	245.	245.	246.	246.	247.	247.
249.	249.	249.	249.	250.	250.	250.	251.	251.	251.
252.	252.	252.	253.	253.	253.	254.	254.	254.	254.
255.	255.	255.	255.	255.	256.	256.	256.	256.	257.
257.	257.	257.	257.	257.	258.	258.	258.	258.	258.
258.	258.	259.	259.	259.	259.	260.	262.	264.	267.
270.	273.	277.	281.	284.	288.	291.	294.	298.	301.
305.	309.	312.	315.	318.	321.	324.	326.	329.	331.
334.	337.	339.	342.	345.	347.	350.	352.	355.	357.
359.	361.	362.	364.	366.	369.	375.	386.	402.	421.
439.	453.	456.	458.	457.	453.	449.	444.	439.	434.
429.	426.	422.	419.	416.	413.	410.	408.	405.	403.
400.	398.	396.	393.	391.	389.	387.	385.	383.	379.
375.	371.	366.	362.	357.	353.	349.	345.	342.	338.
335.	332.	329.	326.	324.	321.	319.	316.	314.	312.
310.	309.	306.	304.	302.	301.	299.	298.	296.	295.
293.	292.	291.	289.	288.	287.	286.	285.	284.	283.
282.	281.	280.	279.	278.	277.	276.	275.	274.	273.
273.	272.	271.	271.	270.	269.	269.	268.	267.	267.
266.	266.	265.	265.	264.	264.	263.	263.		

STAGE

632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0
632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0
632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0
632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0
632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0
632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0
632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0
632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0
632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0	632.0
632.1	632.1	632.1	632.1	632.1	632.1	632.1	632.1	632.2	632.2
632.2	632.2	632.2	632.2	632.2	632.2	632.2	632.2	632.2	632.3
632.3	632.3	632.3	632.3	632.3	632.3	632.3	632.3	632.3	632.3
632.3	632.3	632.3	632.3	632.3	632.3	632.4	632.4	632.4	632.4
632.4	632.4	632.4	632.4	632.4	632.4	632.4	632.4	632.4	632.4
632.4	632.4	632.4	632.4	632.4	632.4	632.4	632.5	632.5	632.6
632.7	632.7	632.8	632.9	633.0	633.1	633.1	633.2	633.3	633.4
633.5	633.5	633.6	633.7	633.8	633.8	633.9	634.0	634.0	634.1
634.2	634.2	634.3	634.3	634.4	634.5	634.5	634.6	634.6	634.7
634.7	634.8	634.8	634.9	634.9	635.0	635.1	635.3	635.6	636.0
636.4	636.6	636.7	636.8	636.7	636.7	636.6	636.5	636.4	636.3
636.2	636.1	636.0	636.0	635.9	635.9	635.8	635.8	635.7	635.7
635.6	635.6	635.5	635.5	635.4	635.4	635.3	635.3	635.3	635.2
635.1	635.0	634.9	634.8	634.7	634.6	634.5	634.4	634.3	634.3
634.2	634.1	634.0	634.0	633.9	633.8	633.8	633.7	633.7	633.6
633.6	633.5	633.5	633.4	633.4	633.4	633.3	633.3	633.3	633.2
633.2	633.2	633.1	633.1	633.1	633.0	633.0	633.0	633.0	632.9
632.9	632.9	632.9	632.9	632.8	632.8	632.8	632.8	632.8	632.7
632.7	632.7	632.7	632.7	632.7	632.6	632.6	632.6	632.6	632.6
632.6	632.6	632.6	632.5	632.5	632.5	632.5	632.5		

PEAK OUTFLOW IS 2495. AT TIME 16.17 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2495.	1076.	320.	320.	94980.
CMS	70.	30.	9.	9.	2676.
INCHES		16.68	20.35	20.35	20.35
MM		423.66	516.86	516.86	516.86
AC-FT		533.	651.	651.	651.
THOUS CU M		658.	803.	803.	803.

HYDROGRAPH ROUTING

CHANNEL ROUTING -MODIFIED PULS- STATION 2 TO 3

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
3	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0800	.0450	.0060	600.0	640.0	150.	.00000

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 640.00 200.00 620.00 525.00 601.00 525.00 600.00 550.00 600.60
550.00 601.00 625.00 620.00 900.00 640.00

STORAGE	0.00	.25	.92	2.00	3.72	5.04	8.44	11.53	15.10	19.16
	23.54	28.30	33.33	38.49	43.86	49.44	55.23	61.23	67.44	73.86
OUTFLOW	0.00	437.50	3615.75	9303.66	18716.99	32505.02	51503.15	76339.77	107453.27	145494.16
	193723.77	252052.00	317420.96	390464.56	470602.12	558135.25	653052.90	755535.05	865653.05	983513.43
STAGE	600.00	602.11	604.21	606.32	608.42	610.53	612.63	614.74	616.84	618.95
	621.05	623.16	625.26	627.37	629.47	631.58	633.68	635.79	637.89	640.00
FLOW	0.00	437.50	3615.79	9363.66	18716.99	32505.02	51503.15	76339.77	107453.27	145494.16
	193723.77	252052.00	317420.96	390464.56	470602.12	550185.25	653052.90	755535.05	865653.05	983518.43

STATION 3, PLAN 1, RTIO 4

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	3.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	2.	3.	5.	7.	9.
12.	14.	16.	19.	21.	23.	25.	27.	29.	31.
33.	35.	37.	39.	41.	42.	44.	45.	47.	40.
50.	51.	53.	54.	55.	56.	58.	59.	60.	61.
62.	63.	64.	65.	66.	67.	68.	69.	70.	71.
71.	72.	73.	74.	74.	75.	76.	76.	77.	78.
78.	79.	79.	80.	81.	82.	86.	93.	102.	114.
129.	142.	157.	173.	188.	203.	219.	234.	258.	279.
319.	337.	366.	392.	419.	444.	468.	490.	514.	530.
562.	588.	614.	641.	668.	694.	719.	742.	765.	786.
806.	823.	839.	854.	874.	905.	956.	1045.	1265.	1529.
1916.	2217.	2403.	2454.	2420.	2325.	2236.	2070.	1952.	1639.
1739.	1643.	1573.	1506.	1448.	1396.	1349.	1304.	1262.	1222.
1107.	1156.	1131.	1112.	1095.	1079.	1063.	1046.	1024.	946.
963.	925.	883.	835.	793.	752.	714.	676.	641.	606.
576.	546.	517.	491.	469.	447.	426.	406.	380.	369.
352.	339.	319.	304.	290.	276.	262.	250.	243.	237.
239.	224.	210.	213.	207.	202.	196.	191.	186.	182.
178.	173.	169.	165.	161.	157.	154.	159.	147.	143.
147.	137.	134.	131.	128.	125.	122.	119.	117.	114.
112.	109.	107.	105.	103.	101.	99.	97.		

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	1.	1.	1.	1.	1.	1.	1.	1.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.		

STAGE

600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0
600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0
600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0
600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0
600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0
600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0
600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0
600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0
600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0	600.0
600.0	600.0	600.0	600.0	600.1	600.1	600.1	600.1	600.1	600.1
600.1	600.1	600.1	600.1	600.1	600.1	600.1	600.1	600.1	600.1
600.1	600.1	600.1	600.1	600.1	600.1	600.1	600.1	600.2	600.2
600.2	600.2	600.2	600.2	600.2	600.2	600.2	600.2	600.2	600.2
600.2	600.2	600.2	600.2	600.2	600.2	600.2	600.2	600.2	600.2
600.2	600.2	600.2	600.2	600.2	600.2	600.2	600.2	600.3	600.3
600.3	600.4	600.4	600.4	600.5	600.5	600.6	600.6	600.6	600.7
600.8	600.8	600.9	601.0	601.1	601.1	601.2	601.2	601.3	601.4
601.4	601.5	601.5	601.4	601.7	601.7	601.8	601.9	601.9	602.0
602.6	602.1	602.1	602.1	602.1	602.2	602.2	602.3	602.4	602.6
602.9	603.2	603.3	603.3	603.3	603.2	603.1	603.0	602.9	602.9
602.8	602.7	602.7	602.6	602.6	602.5	602.5	602.5	602.4	602.4
602.6	602.3	602.3	602.3	602.3	602.3	602.3	602.3	602.2	602.2
602.2	602.2	602.1	602.1	602.0	601.9	601.8	601.7	601.6	601.5
601.4	601.4	601.3	601.2	601.2	601.1	601.1	601.0	601.0	600.9
600.9	600.8	600.8	600.8	600.7	600.7	600.7	600.6	600.6	600.6
600.6	600.6	600.5	600.5	600.5	600.5	600.5	600.5	600.5	600.5
600.4	600.4	600.4	600.4	600.4	600.4	600.4	600.4	600.4	600.4
600.4	600.3	600.3	600.3	600.3	600.3	600.3	600.3	600.3	600.3
600.3	600.3	600.3	600.3	600.3	600.3	600.2	600.2		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2454.	1076.	328.	328.	94490.
CMS	69.	30.	9.	9.	2676.
INCHES		16.68	20.35	20.35	20.35
MM		423.66	516.84	516.84	516.84
AC-FT		533.	651.	651.	651.
THOUS CU M		658.	803.	803.	803.

MAXIMUM STORAGE = 1.

MAXIMUM STAGE IS 603.3

D-24

HYDROGRAPH ROUTING

CHANNEL ROUTING -MODIFIED PULS- STATION 3 TO 4

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	4	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP		LSTR
0.0	0.000	0.00	1	1	0	0		0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	0.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.1000	.0450	.1000	520.0	560.0	1050.	.00060

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 560.00 100.00 540.00 290.00 522.00 290.00 520.00 310.00 520.00
310.00 522.00 500.00 540.00 700.00 560.00

STORAGE	0.00	1.02	3.27	7.70	14.55	23.57	34.05	48.30	64.17	82.21
	102.43	124.33	147.83	172.94	199.65	227.96	257.07	289.39	322.51	357.23
OUTFLOW	0.00	573.66	2352.73	4958.89	9761.16	16863.41	26633.36	39413.57	55527.40	75202.83
	99644.93	128704.15	161980.44	199309.66	241132.34	287491.51	338531.40	394396.63	455231.50	521179.91
STAGE	520.00	522.11	524.21	526.32	528.42	530.53	532.63	534.74	536.84	538.95
	541.05	543.16	545.26	547.37	549.47	551.58	553.68	555.79	557.89	560.00
FLOW	0.00	573.66	2352.73	4959.89	9761.16	16863.41	26633.36	39413.57	55527.40	75202.83
	99644.93	120704.15	161903.44	199309.66	241132.34	287491.51	330531.40	394390.63	455231.50	521179.91

STATION 4, PLAN 1, RTIO 4

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	3.	0.	0.	1.	2.	3.	5.	7.	9.
11.	13.	16.	18.	20.	23.	25.	27.	29.	31.
33.	35.	37.	38.	40.	42.	43.	45.	47.	48.
50.	51.	52.	54.	55.	56.	57.	59.	60.	61.
62.	63.	64.	65.	66.	67.	68.	69.	70.	70.
71.	72.	73.	73.	74.	75.	76.	76.	77.	77.
78.	79.	79.	80.	80.	82.	85.	91.	100.	111.
124.	139.	154.	163.	184.	199.	215.	230.	246.	273.
301.	333.	358.	386.	412.	438.	462.	484.	507.	532.
556.	581.	608.	635.	662.	684.	713.	737.	760.	782.
802.	820.	835.	851.	869.	897.	943.	1022.	1164.	1445.
1923.	2153.	2369.	2451.	2431.	2353.	2234.	2106.	1979.	1863.
1760.	1689.	1593.	1520.	1460.	1400.	1359.	1314.	1271.	1231.
1195.	1187.	1136.	1116.	1099.	1083.	1067.	1053.	1029.	1003.
971.	934.	893.	845.	802.	761.	722.	685.	649.	615.
583.	553.	524.	498.	474.	453.	432.	412.	392.	374.
356.	343.	323.	304.	293.	279.	266.	253.	244.	239.
232.	226.	223.	214.	208.	203.	198.	192.	188.	183.
179.	174.	170.	166.	162.	158.	155.	151.	147.	144.
141.	139.	134.	131.	128.	126.	123.	120.	117.	115.
112.	119.	109.	165.	103.	101.	99.	97.		

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	2.	2.	2.	2.	2.
3.	3.	4.	4.	4.	4.	4.	3.	3.	3.
3.	3.	3.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
2.	2.	2.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.		

STAGE

520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0
520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0
520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0
520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0
520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0
520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0
520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0
520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0
520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0	520.0
520.0	520.0	520.1	520.1	520.1	520.1	520.1	520.1	520.1	520.1
520.1	520.1	520.1	520.1	520.1	520.2	520.2	520.2	520.2	520.2
520.2	520.2	520.2	520.2	520.2	520.2	520.2	520.2	520.2	520.2
520.2	520.2	520.2	520.2	520.2	520.2	520.2	520.3	520.3	520.3
520.3	520.3	520.3	520.3	520.3	520.3	520.3	520.3	520.3	520.3
520.3	520.3	520.3	520.3	520.3	520.3	520.3	520.3	520.4	520.4
520.5	520.5	520.6	520.6	520.7	520.7	520.8	520.8	520.9	521.0
521.1	521.2	521.3	521.4	521.5	521.6	521.7	521.8	521.9	522.0
522.0	522.1	522.2	522.2	522.2	522.3	522.3	522.3	522.4	522.4
522.4	522.5	522.5	522.5	522.5	522.6	522.6	522.7	522.9	523.3
523.9	524.3	524.4	524.5	524.5	524.4	524.3	524.2	524.1	523.9
523.9	523.7	523.5	523.5	523.4	523.3	523.2	523.2	523.1	523.0
523.0	522.9	522.9	522.9	522.9	522.8	522.8	522.8	522.8	522.7
522.7	522.6	522.6	522.5	522.4	522.4	522.3	522.3	522.2	522.2
522.1	522.0	521.9	521.8	521.7	521.7	521.6	521.5	521.4	521.4
521.3	521.2	521.2	521.1	521.1	521.0	521.0	520.9	520.9	520.9
520.9	520.8	520.8	520.8	520.8	520.7	520.7	520.7	520.7	520.7
520.7	520.6	520.6	520.6	520.6	520.6	520.6	520.6	520.5	520.5
520.5	520.5	520.5	520.5	520.5	520.5	520.5	520.4	520.4	520.4
520.4	520.4	520.4	520.4	520.4	520.4	520.4	520.4		

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2451.	1076.	320.	320.	94471.
CMS	69.	30.	9.	9.	2675.
INCHES		16.69	20.34	20.34	20.34
MM		423.63	516.70	516.70	516.70
AC-FT		533.	651.	651.	651.
THOUS CU M		658.	803.	803.	803.

MAXIMUM STORAGE = 4.

MAXIMUM STAGE IS 524.5

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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .25	RATIO 2 .50	RATIO 3 .75	RATIO 4 1.00
HYDROGRAPH AT	1	.68	1	1066.	2133.	3199.	4266.
	(	1.55)	(	30.20)(	60.39)(	90.59)(	120.79)(
ROUTED TO	2	.68	1	372.	918.	1541.	2499.
	(	1.55)	(	10.53)(	26.01)(	43.64)(	69.52)(
ROUTED TO	3	.68	1	372.	919.	1542.	2494.
	(	1.55)	(	10.54)(	26.01)(	43.68)(	69.49)(
ROUTED TO	4	.68	1	372.	919.	1539.	2491.
	(	1.55)	(	10.53)(	26.02)(	43.59)(	69.48)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	632.00	632.00	635.50
STORAGE	240.	240.	399.
OUTFLOW	0.	0.	1125.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.25	633.64	0.00	312.	372.	0.00	16.42	0.00
.50	635.00	0.00	370.	918.	0.00	16.33	0.00
.75	636.01	.51	421.	1541.	1.25	16.25	0.00
1.00	636.76	1.26	458.	2499.	2.00	16.17	0.00

PLAN 1 STATION 3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.25	372.	680.9	16.42
.50	919.	682.2	16.33
.75	1542.	682.6	16.25
1.00	2494.	683.3	16.17

PLAN 1 STATION 4

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.25	372.	521.4	16.42
.50	919.	522.6	16.33
.75	1539.	523.5	16.25
1.00	2491.	524.5	16.17

Form [illegible]

Dam Application No. 448
(22-1[illegible]1)

State of New Jersey

State Water Policy Commission

REPORT ON DAM APPLICATION

To the State Water Policy Commission,
State of New Jersey.

Gentlemen:

The application of Highland Lakes, Inc., Main Street, Paterson, N. J.

filed December 7, 1950 for approval of plans and for a permit to construct a dam

known as HIGHCREST [illegible] Lake near Smith Mills on a small branch

tributary to Pequannock River in Passaic County, New Jersey.

has been examined by Norman C. Wittwer, Principal Hydraulic ~~[illegible]~~ Engineer.

PRINCIPAL FEATURES

Location 22.3[illegible] — Site inspected [illegible] – [illegible]; 12.7.50 – "

Purpose of dam [illegible] Estate Development — Length of dam [illegible] feet

Drainage area [illegible] sq. mi. — Elevation of flow line [illegible] (assumed datum)

Area of Lake [illegible] acres — Capacity of lake [illegible] Mill. gals.

Type of dam Earth fill, concrete core wall — Top width [illegible] feet

Upstream slope 2 to 1 — Downstream slope 1½ to 1

Foundation material [illegible] clay — Max. height [illegible].5 feet

Type of spillway [illegible] — Length of spillway [illegible] feet

Max. head on spillway [illegible] feet ([illegible] ft. freeboard)

Spillway capacity [illegible] sec. ft. [illegible] sec. ft per sq. mi. ([illegible] ft. freeboard)

Estimated maximum flood flow [illegible] sec. ft per sq. mi. (North Jersey [illegible])

Outlets other than spillway 12 [illegible] pipe and gate

Drawings filed [illegible] Harrison, Engineer, N. J. License No. [illegible]

It has been found that the site for the dam is suitable and the plans adequate to ensure the construction of a structure which will not be a menace to life or property. It is therefore recommended that the plans be approved and that a permit be issued, subject, however, to the following terms and conditions:—

1. That this permit does not give any property rights, either in real estate or material, nor any exclusive privileges; neither does it authorize any injury to private property nor invasion of private rights, nor any infringement of Federal, State or local laws or regulations, nor does it waive the obtaining of Federal assent, when necessary.

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PLATE D-1

1000 0 1000 2000 3000 4000

SCALE IN FEET

AREA LOCATION

HIGH CREST LAKE DAM

JENNY- LEEDSHILL JANUARY 1979

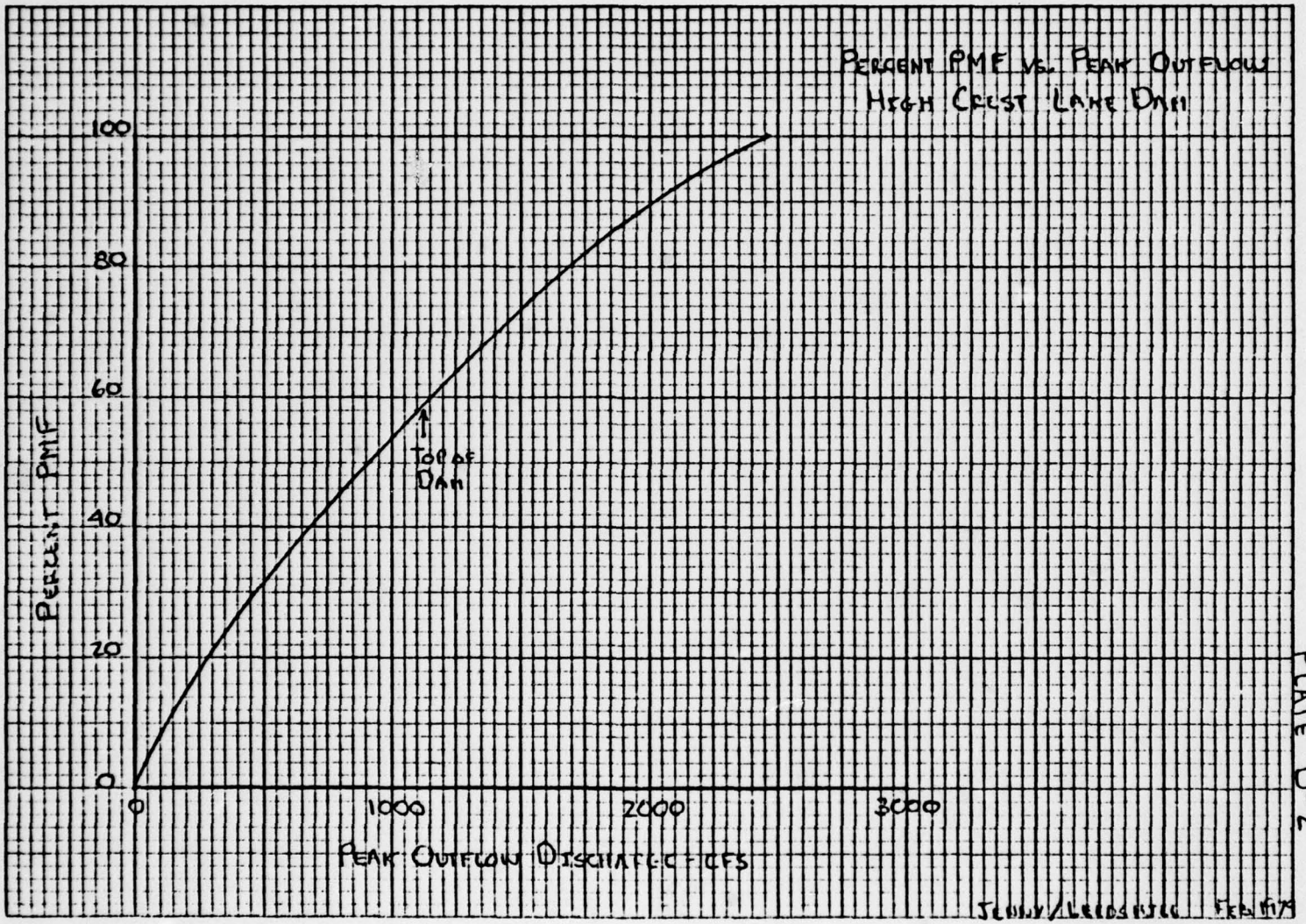

PLATE D-2

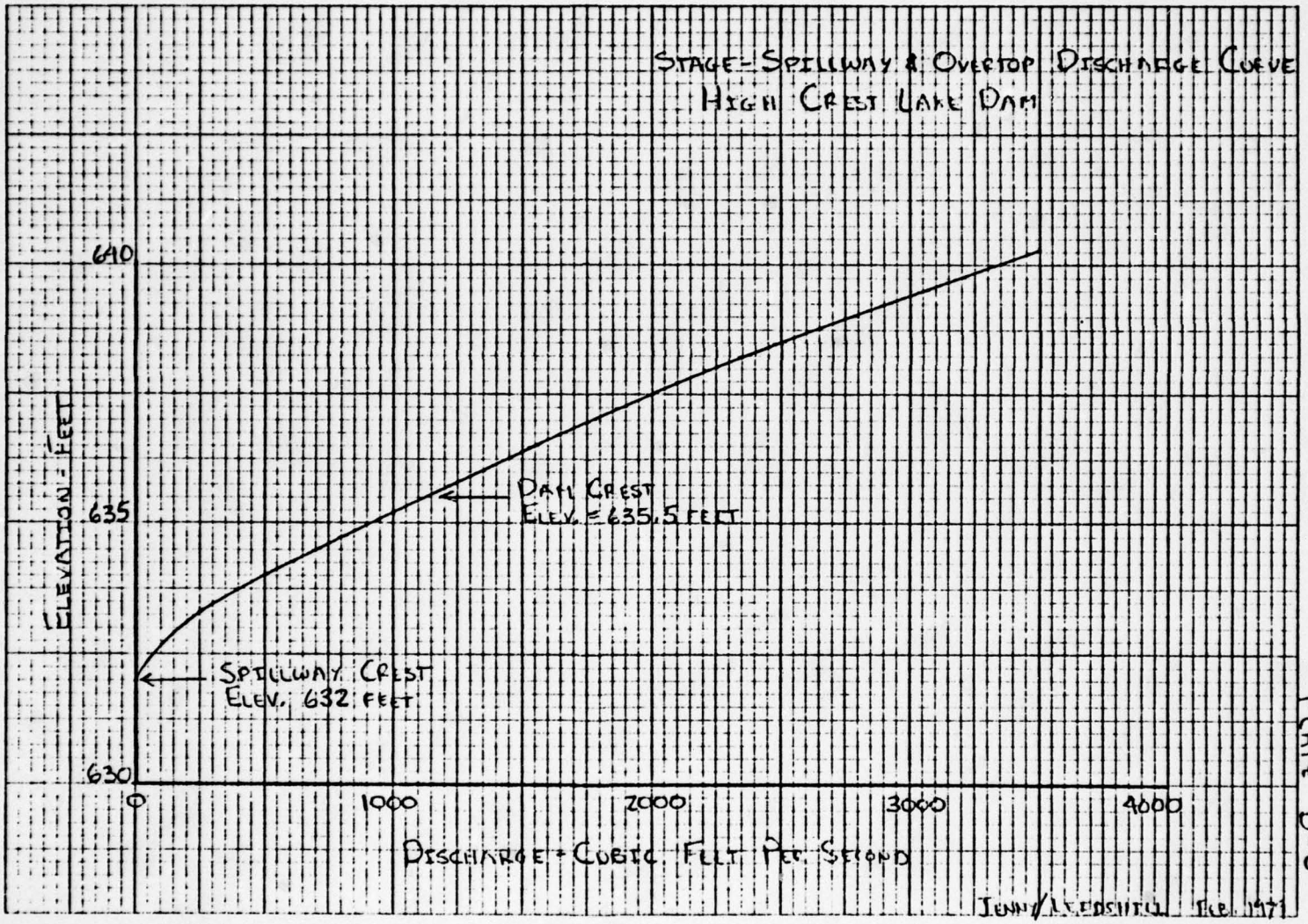

PLATE D-8

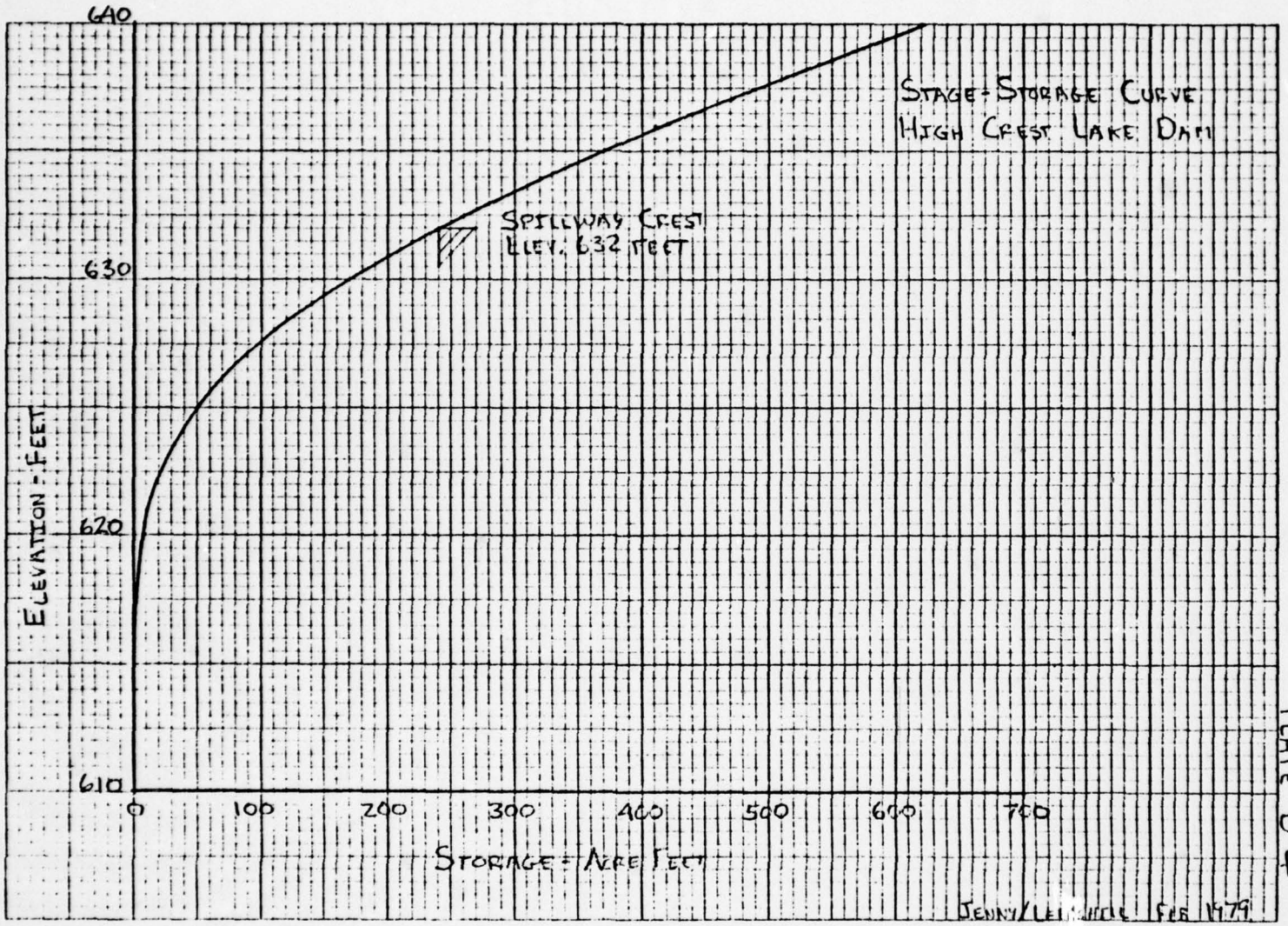

PLATE D-4